PETROLEUM PROCESSING

including Petrochemical Processing Section

JULY 1952

Petroleum Syndet Boom

Output jumps because of enough raw materials, and simple processing needs — p. 982

Keep the Motors Going

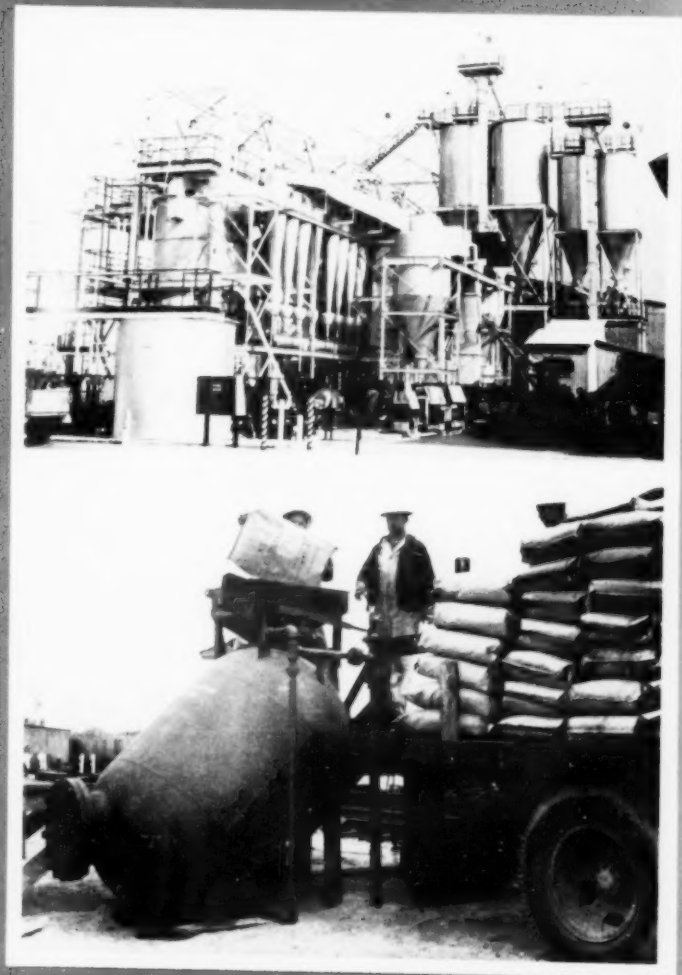
Do's & don'ts for electric controller maintenance cut repair costs — p. 950

Get What You Order

Tips on buying cooling towers renews "how to" series that readers liked during 1951 — p. 958

Catalyst Zips to Bin

Simple air system blows it at 175 lb/min rate in Utah plant — p. 991



After two years of development and test work confirmed in the operation of the large West Texas installation pictured below,

HUDSON presents the

Combin-aire*

A New Type Cooling System Integrated for All Process Plant Cooling Services, Combining the Economical Maximum Use of Air With Minimum Use of Water.

In the COMBIN-AIRE the use of air for cooling is extended to include low temperature cooling services previously necessitating water cooling because of high ambient air temperature. The COMBIN-AIRE allows the use of air-cooling for total heat dissipation in all services.

The COMBIN-AIRE is a combination of a HUDSON water cooling tower with HUDSON air-cooled exchangers housed in one integrated structure. During periods of high ambient temperature the inlet air is first drawn through water at the bottom of the cooling tower, reducing the air to near wet-bulb temperature, at which temperature it contacts the air-cooled exchangers. During periods of low ambient temperature the inlet air is used directly in the air-cooled exchangers and no water is evaporated in the cooling tower.

When water in good quantity and quality is not available the COMBIN-AIRE has manifest advantages over any alternative combination of cooling equipment.

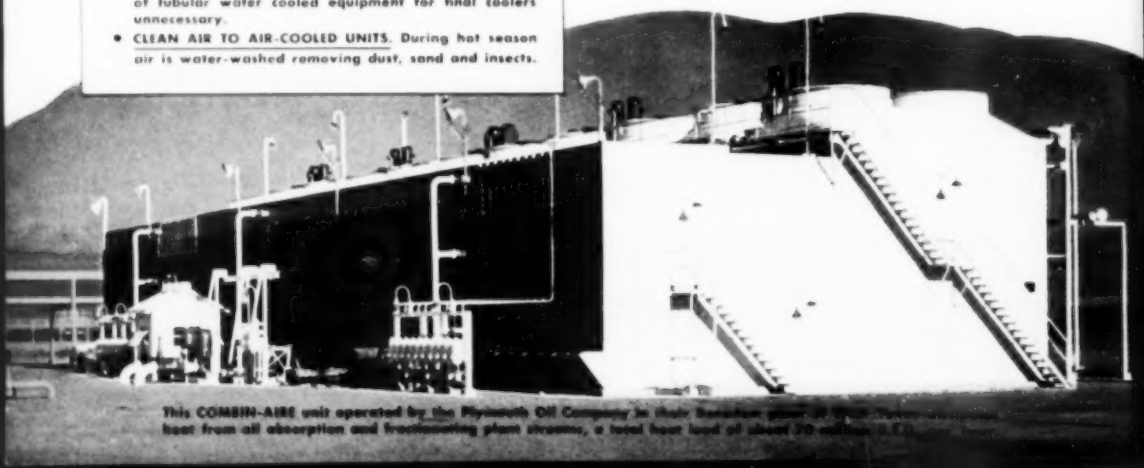
Even when ample water is available and water treatment costs are low, comprehensive comparisons will frequently indicate overall advantages of the COMBIN-AIRE system.

* The COMBIN-AIRE unit is protected by United States patents

COMBIN-AIRE ADVANTAGES

- **LOW WATER CONSUMPTION.** No water is used during cold weather.
- **NO TREATMENT NECESSARY** for cooling tower water.
- **NO WATER LOSS** as spray or mechanical carryover.
- **NO CONDENSATION** from effluent air.
- **MINIMUM PIPING.** COMBIN-AIRE may be installed immediately adjacent to other process equipment. Use of tubular water cooled equipment for final coolers unnecessary.
- **CLEAN AIR TO AIR-COOLED UNITS.** During hot season air is water-washed removing dust, sand and insects.

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS



This COMBIN-AIRE unit operated by the Plymouth Oil Company in their Sweetwater plant [illegible] heat from all absorption and fractionating plant streams, a total heat load of about 70 million B.T.U.

We're shipping from Texas now!

Cars of "Ethyl" antiknock compound are now starting to roll out of our new Texas plant.

In case you haven't heard the full story of this new plant . . . we have just completed a new antiknock compound manufacturing center on the Houston ship channel in Texas. It's the most modern plant of its kind in the world . . . the only one west of the Mississippi.

continued on next page

ETHYL
ANTIKNOCK COMPOUND
ETHYL CORPORATION

We're shipping from Texas now!

continued from preceding page

This new plant greatly increases Ethyl's manufacturing capacity, and our ability to serve the nation's petroleum industry. It's a completely "integrated" plant. All the complex chemicals needed to produce tetraethyllead are made here from raw materials such as salt, pig lead, petroleum gases and electricity. The location of the new plant was picked to be near these basic raw materials.

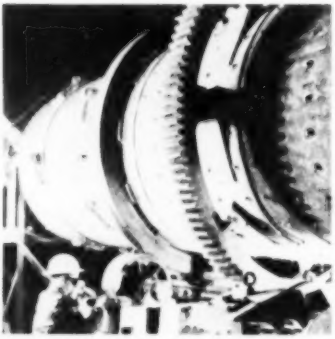
Today, we can dispatch Ethyl fluid to you from any one of *four* shipping points, Baton Rouge, Louisiana; Houston, Texas; Edge Moor, Delaware; and Wilmington, California. Refiners are now, more than ever before, assured of a dependable supply of "Ethyl" antiknock compound delivered where and when they want it.

ETHYL CORPORATION

NEW YORK 17, NEW YORK

Ethyl service is backed by 29 years of antiknock experience

HERE ARE A FEW OF THE MANUFACTURING UNITS IN OUR NEW TEXAS PLANT



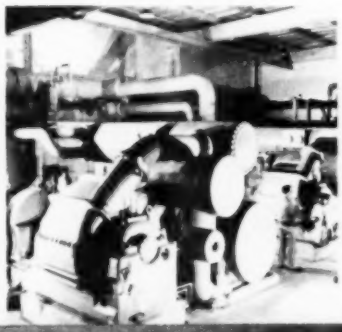
A SALT DRYER IN THE SODIUM BUILDING

HIGH VOLTAGE LINE FOR SODIUM CELLS

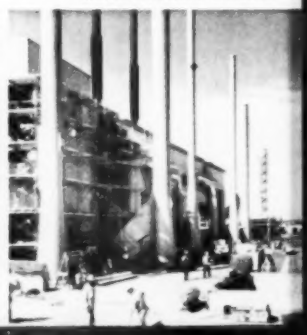
THIS IS THE ETHYL DICHLORIDE PLANT

THE ETHYL CHLORIDE UNIT IS A PLANT IN ITSELF

REFRIGERATION COMPRESSORS IN THE ETHYL CHLORIDE UNIT



TETRAETHYLLEAD MANUFACTURING BUILDING



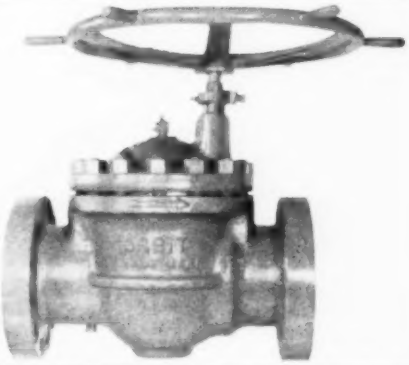
SPECIFY ORBIT VALVES® FOR

PRODUCTION and FLOWLINE SERVICE

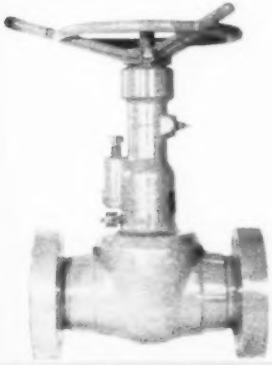
Orbit Forged Steel Valves have been designed with a friction free seating principle. To the operator this means longer service at lower maintenance costs because the absence of friction in seating means greatly reduced wear at the point of seat contact. It is not necessary to tighten Orbit Valves to the extreme to obtain positive closure, due to their unique seating principle. Since there is no contact between the seating core and the body, or the seating core and the body seat in the process of opening or closing, there is no rubbing or scuffing of the valve seating surfaces. The extreme ease of operation of Orbit Rising Stem Production Valves is due to this fact. Fluid loads acting on the valve seating core are applied to the trunnions, rather than on the spherical seating surfaces, thus reducing the frictional lever arm to a minimum, as well as the torque necessary to rotate the core. Orbit's friction free seating principle coupled with an exceptionally strong operating mechanism, both of which are contained in an all Forged Steel body and bonnet, is your assurance for dependable, trouble free service.

PRODUCTION SERVICE

For many years Orbit Drilling Valves have been used to control commercial gas wells and gas storage wells all over the United States, Canada and foreign countries. Thousands of them have been operated daily and have never been out of service. Orbit Drilling Valves have been chosen for these services because they afford low cost maintenance, easy operation and a positive dependable shut-off in all kinds of weather conditions. "Switching" operations can be quickly performed by one man when a lease is equipped with these easy operating valves. Orbit Drilling Valves are made in sizes 5½", 7", 8⅝" and 10¾", Screw End and Flanged End and Cross Type. All Orbit Drilling Valves are furnished equipped with handwheel that is detachable.



L. P. GAS SERVICE



The Orbit resilient, friction free seating principle is a natural for holding liquefied petroleum gases. Regardless of minor body deflections, contraction or expansion brought about by fluctuating temperatures or pressures, the Orbit seating principle is not affected. No lubricant of any kind is required in the valve body to effect a shut-off; therefore maintenance of Orbit L. P. Gas Valves requires a minimum of expense and attention. Orbit L. P. Gas Valves also feature an all forged steel body and bonnet plus welded bonnet construction and adjustable reliable plastic stem packing. This combination makes the Orbit L. P. Gas Valve the "last word" in safety and dependability. The use of Orbit L. P. Gas Valves is your assurance against fluid contamination. You can buy Orbit Valves with confidence because they are designed to handle your hard-to-hold hydrocarbons and vapors.

BRANCHES

HOUSTON, TEXAS
407 Velasco
(Serving the Gulf Coast)

ODESSA, TEXAS
402 West County Road
(Serving West Texas)

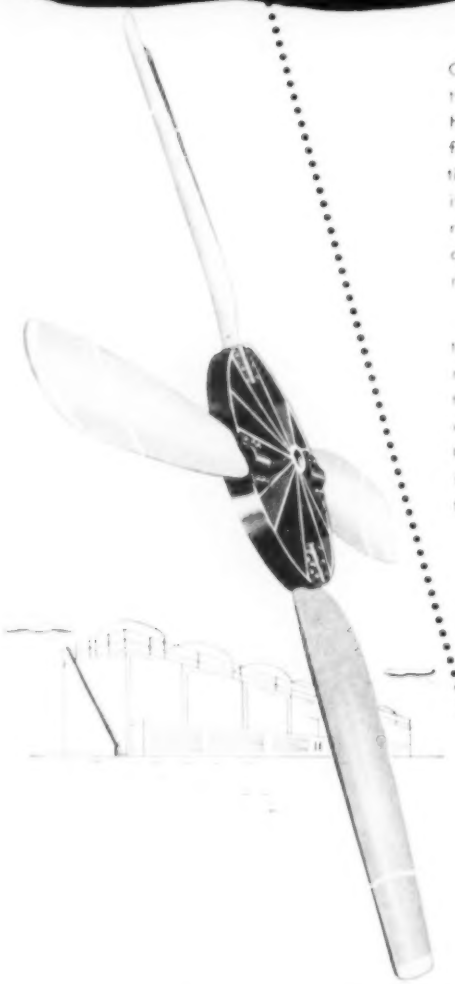
CASPER, WYOMING
LeRoy Mitchell, Distributor
(Serving the Rocky Mountain States and Canada)

ORBIT VALVE CO.

P. O. Box 699 TULSA 1, OKLA.

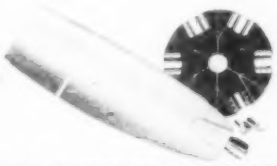
HARTZELL COOLING TOWER FANS

--dependability under the worst of weather and wear

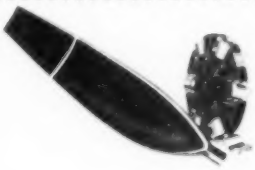


Corrosion, vibration, abrasion. These are the big headaches of the cooling tower fan operator. And these are the problems Hartzell engineers consider when they design cooling tower fans. The exclusive Hartzite plastic blade makes this fan practically impervious to acid and alkali corrosion and weathering, it greatly reduces the possibility of vibration damage. A plastic reinforcement at the base of each blade prevents concentration of flexing at the shank. And the rugged Hartzell hub packs tremendous strength—far beyond any calculable needs.

Sizes that range from 10 feet to 22 feet in diameter give the cooling tower operator the opportunity to select exactly the right type of fan for his installation. If you are in doubt as to the type of fan to use—call your Hartzell field engineer for the answer. Regardless of your location, there's one near you. Or, if you desire more information, write for the newly revised bulletin 1503 which gives the details about Hartzell cooling tower fans.



Blade and hub construction used on the 14 to 22 foot models.



Blade and hub construction used on the 10 to 13 foot models.

CLIP AND MAIL THIS COUPON NOW FOR INFORMATION

HARTZELL PROPELLER FAN CO.
Div. of Castle Hills Corp.
PIQUA DEPT. K **OHIO**

Name _____
Company _____
Street & No. _____
City & State _____

PROPELLER-TYPE FANS AND BLOWERS • ROOF VENTILATORS • UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

July, 1952
Vol. 7, No. 7

PETROLEUM PROCESSING

Covering petroleum research and the design, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals

Contents

FEATURE ARTICLES

Refining Section

IS Spcialized Engineering Needed? 947
Readers reply to article in May issue on training of petroleum refinery engineers

Maintaining Electric Controllers 950
DO's and DON'T's to prevent costly repairs and downtime on motors, by L. E. Markle

Profits from Dynamic Balancing 956
Rapid, accurate and safe test for wear and vibration in rotating parts of pumps or turbines, by R. W. Lortz

How to Get What You Need When You Order Cooling Equipment 958
No. 7 in a series on How to Order Equipment, by D. P. Thornton, Jr.

Evolution of a Fluid Cracker 963
Orthoflow, the most recent catalytic cracking design, shows trend toward smaller structures

Want Lower Costs on Can Filling? 964
Gulf estimates savings up to $54,000 yearly possible by reducing average overfill 1% by volume

Thermofor Catalytic Cracking 966
Design details, pilot plant data, economics of this new reforming process, by J. W. Payne, L. P. Evans, E. V. Bergstrom and V. O. Bowles

Micro Method for Octane Tests 970
Here's how to run octane ratings with 20-40 ml. samples, by R. F. Galloway

Special Engine Tests Diesel Lubes 972
Sinclair Labs get first small scale railroad diesel for checking petroleum products

Petroleum Chromatography 973
Part 2—Technological Era, with a discussion of current developments, by Herbert Weil

Petrochemical Section

Acetylene for Petrochemicals 977
Will new ways for making it from natural gas push ethylene out of the limelight? by V. B. Guthrie

Detergents from Petroleum 982
Output has jumped 650% in 7 years as result of ample raw materials, simple processing need, by Foster Dee Snell

Petrochemicals for Canada 987
Celanese affiliate builds new Edmonton plant with know-how obtained from Bishop plant's operations, by David R. Keck

DEPARTMENTS

Publisher's Page	901	Patents	997	Operating Trends	1029
What's Happening	903	Personals	1009	Advertiser's Index	1032
Tomorrow	907	Suppliers	1013	What's New	1033
Letters	913	Books	1023	Literature Offered	1047
Plant Practices	991	Meetings	1027	Editorial	1048

A Platt Petroleum Publication

1213 West Third St., Cleveland 13, O.

Editorial Staff

Virgil B. Guthrie, *Editor*
50 West 50th St., New York 20.
William F. Bland, *Engineering Editor*
William C. Uhl, *Equipment Editor*
D. P. Thornton, Jr., *Southwestern Editor*
810 First Nat'l. Bank Bldg., Houston 2.
Frank Breese, *West Coast Editor*
416 West 8th St., Los Angeles 14.
Andrew R. Patla, *Washington Editor*
1046 Nat'l Press Bldg., Washington 4.
Eugene F. Gibbons, *Editorial Assistant*
Verne Nazarek, *Production Manager*
Peter J. Gaylor, *Patent Reviewer*

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

This gasoline plant asked:

"Can You Clean a Complete Cooling System?"

Dowell Service increased the system's capacity by 40%

Production at this gasoline plant was greatly reduced because deposits had built up in the cooling system. Originally designed to operate at 5,000 gallons of water per minute, the cooling system could handle only 3,000 g.p.m.

Dowell engineers devised a method of cleaning which restored the system to its designed capacity. The entire job was done in less than seven hours.

Liquid solvents were introduced through regular connections into tube and shell condensers, water jackets and various sizes of lines. It was not necessary to dismantle the equipment. It was estimated that the increased production of the plant would pay for the cleaning job in a matter of days.

Dowell Service is used to clean many different types of refinery equipment—condensers, process towers, pipe lines, storage tanks, boilers, heat exchangers and other operating equipment. Dowell furnishes all necessary trained personnel, chemicals, pump trucks and controls.

Dowell engineers, backed by experience in many jobs, will be glad to discuss your maintenance cleaning problems with you at no obligation. Call the nearest of 90 Dowell offices today.

Other recent Dowell jobs:

An amine after cooler in a refinery was cleaned by Dowell Service. As a result, the product outlet temperature dropped from 180° F. to 90° F.

•

A hard carbon deposit was completely removed from the air side of an air compressor by Dowell Service.

•

A municipal water well was treated by Dowell Service. Production increased from 87 gallons per minute at 40 ft. drawdown to 800 g.p.m. at only 11 ft. drawdown.

CALL

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

New York 17	Ft. Worth 2	Atlanta	Mt. Pleasant, Mich.
Boston 16	Chicago 4	Indianapolis	Hamilton, Ohio
Baltimore	St. Louis 6	Louisville	Charleston, W. Va.
Wilmington 99	Kansas City 6	Upper Montclair, N. J.	Salem, Illinois
Richmond 19	Wichita 2	Ardmore, Pa.	Beaumont, Texas
Jacksonville	Oklahoma City 2	Anniston, Alabama	Borger, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Midland, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Wichita Falls, Texas
Pittsburgh 22	Shreveport 68	Dearborn, Mich.	Hobbs, N. Mex.

* *Maintenance cleaning service for industrial heat exchange equipment.*

* *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY

PETROLEUM PROCESSING

Publisher's Page

A Platt Petroleum Publication

1213 West Third St., Cleveland 13, O.

ABP ABC

Warren C. Platt, *President*

Albert W. Boulton, *Vice President*

A. E. Kraft, *Treasurer*

Business Staff

Albert W. Boulton, *Sales Manager*

R. H. Loyer, *Circulation Manager*

F. A. Gregory, *Advertising Production Manager*

Regional Sales Representatives

NEW YORK 20, N. Y.
P. S. Carberry, 50 West 50th St

PHILADELPHIA 2, PA.
C. J. Jafferis, 1422 Chestnut St

CHICAGO 5, ILL.
R. D. Henriquez, 59, East Van Buren St

CLEVELAND 13, OHIO
Richard N. Jorgenson, 1213 West 3rd St

HOUSTON 2, TEXAS
George Reid, 810 First Nat'l. Bank Bldg.

SAN FRANCISCO 4, CALIF.
Robert W. Walker Co., 57 Post St.

LOS ANGELES 5, CALIF.
R. W. Walker, 2330 West 3rd St.

Published second Tuesday of each month by National Petroleum Publishing Co., 1213 West Third St., Cleveland 13, Ohio. Subscriptions: $8.00 a year in U.S. and possessions, $8.50 a year elsewhere. Single copies, 75 cents each; back copies more than three months old, $1.00 each. Microfilm copies available through University Microfilms, Ann Arbor, Mich. *Petroleum Processing* is indexed regularly in Industrial Arts Index, Engineering Index and Chemical Abstracts. Published prior to Sept., 1946, as the *Technical Section* of *National Petroleum News*, devoted to Refinery Management and Petroleum Chemical Technology, and including *International Petroleum Technology*. Trade mark registered U.S. Patent Office. Copyright 1952 by National Petroleum Publishing Co. Acceptance under the act of June 5, 1934, at Cleveland, Ohio, authorized Dec. 22, 1948.

Pardon Us if We Strut a Bit

A year ago last winter, Dave Thornton, our Southwestern Editor, was given an unusual and difficult assignment. He was asked to work up information that would contribute to greater cooperation between buyers and sellers of petroleum processing equipment. His objective was to help ensure the selection of the right plant equipment for specific service requirements by creating an awareness of the need—as well as a working tool—for more thorough interchange of information between equipment manufacturers and equipment users.

The result was Dave's series on "How to Order Equipment" that started in the July 1951 issue of PETROLEUM PROCESSING. In Army parlance, Dave really "sweated this one out" in more ways than one. The basic leg-work on some of the articles was done during those torrid days of July, August and September last year when the Southwest was setting new consecutive heat records. He personally contacted 47 men in different phases of the equipment business in putting together the first six articles of the series, which dealt with such equipment items as valves, pumps, heat exchangers, compressors and control instruments.

The judges of *Industrial Marketing* magazine's 1952 Editorial Competition certainly felt that an outstanding contribution was made to the industry by these articles. The series received an "Award of Merit" as one of the three best series of articles published by industrial publications during 1951. Since this is the first year that PETROLEUM PROCESSING has entered this competition, we are almost as proud of winning this award as my five-year old son was in being promoted from kindergarten to first grade a few weeks ago—particularly in light of the competition of several hundred entries from other well known industrial publications.

A number of you must have agreed with the judges in this contest, if your numerous favorable letters and requests for over 16,000 reprints of the individual articles are a fair measurement.

Another article in this "blue ribbon" series appears on p. 958 this month, and deals with cooling equipment. While each article has specialized interest to certain readers, many more of you should find ideas in them that are generally applicable to your operations.

A. W. Boulton

Other Platt Petroleum Publications

National Petroleum News
The weekly oil marketing magazine covering news, prices, transportation, storage, merchandising

Platt's Oilgram News
A daily independent oil-news reporting service issued from New York, Cleveland and Houston

Platt's Oilgram Prices
A daily independent oil-price reporting service issued from New York, Cleveland and Houston

Only 2 Years Old . . .

1951

1950

In its relatively brief history, Procon has completed or has under construction, 22 major refinery installations for refiners in the United States and overseas.

Procon jobs include UOP Platforming units, fluid catalytic cracking units, polymerization plants, feed preparation units, Udex units and in addition, numerous fractionation and refinery processing facilities.

but a world of experience

PROCON is only two years old, but the total experience of the organization adds up to years and years of practical construction knowledge.

Every Procon job is administered by a group that has long worked together on the installation and operation of all types of refinery processing equipment. Engineering and field work are handled by highly competent staffs, adequate in size and well-equipped in experience.

This combination provides *a complete process construction service* that has quickly made its mark in the petroleum refining and petrochemical industries.

PROCON *Incorporated*

PROCESS CONSTRUCTION

75 EAST JACKSON BLVD., CHICAGO 4, ILLINOIS

What's Happening . . .

Expansion

. . . **Projects to boost basic refining capacity** by 1,278,000 b/d have been approved by PAD for rapid tax amortization since program was initiated in Nov. '50, according to survey released by agency June 26. Survey covers operations only through May 30, '52.

For other segments of processing industry, PAD said following expansion has been indicated by tax-approved projects:

Natural gasoline processing	200,000 b/d
Lubricating oils	5,900 b/d
Lube oil additives	10,900,000 lbs./month
Cracking catalysts	12,600 lbs./month
Sulfur	427,945 long tons/year

PAD emphasized that data on tax certificates is not an accurate measurement of total expansion, since "many oil and gas operators have gone ahead with various projects without seeking any accelerated tax amortization." Of basic refining expansion approved, most of it is not included in 18-month expansion program which got under way July 1, calling for 750,000 b/d of new capacity by end of '53.

. . . **PAD's actions on applications** from all branches of industry is given in following tabulation:

	Projects Filed	Approved	Denied	Value Aproved (Millions)
Basic Refining	321	227	29	$ 998
Oil storage and transportation	391	245	59	537
Gas transmission, distribution, manufacture, storage	69	39	20	270
Alkylation, aromatics, TEL	120	116	0	219
Natural gasoline	172	118	29	186
Petrochemicals	58	25	10	129
Lubricating oil and additives	51	31	16	65
Cracking catalysts	16	13	0	27
Sulfur	36	31	1	22
Oil field equipment, machinery	38	6	27	8
Production	1	0	1	0
Marketing facilities	2	0	2	0
TOTALS	278	851	194	$2,461

[1] Includes 223 applications still being processed by PAD.
[2] Includes 30 applications still being processed by Defense Production Administration.

. . . **Still short of goals** are sulfur and high viscosity index lube oils, in addition to basic refining capacity. Sulfur program called for 500,000 long tons/year from petroleum, and is nearly 15% below that figure. Lube oil program called for start of construction of solvent refining capacity for 15,000 b/d of high VI oils by end of '52, and an additional 13,000 b/d by '55.

. . . **Texas City Refining** has let contract to Kaiser Engineers Division of Henry J. Kaiser Co., Oakland, Calif., for construction of a 19,000 b/d Houdriflow catalytic cracking unit at its 60,000 b/d Texas City, Texas, refinery. Unit will incorporate a visbreaker in the catalytic circuit to provide additional charge stocks to the catalytic reactor from heavy fuel oil. It will supplant an existing 10,000 b/d fixed-bed Houdry cracker. Completion is expected during last quarter of '52.

. . . **Suntide Refining Co.** is new firm set up to build and operate proposed 25,000 b/d refinery which Sunray Oil Corp. had planned to put up at Corpus Christi, Texas (see What's Happening, Oct. '51, p. 1051, and Mar. '52, p. 271). President is F. L. Martin, former executive vice president for refining with Sunray, which has 50% interest in new firm.

. . . **Phillips Petroleum Co.** has completed plans for a new 60 MMcf/day natural gasoline plant in the Spraberry Trend of West Texas. The new Pembrook plant will be located 20 mi. south of Phillips new Spraberry plant now under construction. Latter plant was originally designed for 60 MMcf/day, but that is now being increased to 150 MMcf/day. First of new facilities is expected to operate late this year, others early next year.

Petrochemicals

. . . **W. R. Grace Co.**, New York, will enter the petrochemical field by erecting a 250 ton/day ammonia-from-natural gas plant "somewhere in the Southwest." A goodly portion of the ammonia will be converted to urea. A certificate of necessity for "nitrogen" was issued the company earlier this year for $15,466,000 at 45%, location being designated as "near New Orleans, La." Grace Co. owns over 50 subsidiaries, operate the Grace Line Inc., a shipping and trading concern, and have extensive interests in the food and textile industries of South America.

. . . **Celanese Corp. of America** is now commercially producing n-propyl acetate and is offering the material in tank car, tank wagon, and drum quantities. The product is made at the Bishop, Tex., plant, using natural gas raw materials, and is also scheduled for production at the new Edmonton, Alberta, plant of Canadian Chemical and Cellulose Co. Ltd., a Celanese subsidiary (see pg. 987 this issue).

. . . **Carbide & Carbon Chemicals Co.** will build their new multi-million dollar petrochemical plant about eight miles northwest of Seadrift in Calhoun County, Tex. Plant will produce primarily ethylene oxide and polyethylene resins, using petroleum gases as principal raw material. Certificate of necessity has been granted and field work on the project is scheduled to begin early this fall. Brown & Root Inc., Houston, will design and construct the plant.

. . . **Jefferson Chemical Co.** plans a $14,700,000 expansion of facilities at its Port Neches, Tex., plant to manufacture ethylene oxide and ethylene glycol via the direct oxidation of ethylene. Included are an additional feed gas line from The Texas Co.'s

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

Port Arthur Works, an ethylene cracking and fractionating unit, and ethylene oxide and ethylene glycol units. Additional steam-generating, water-treating and water-cooling equipment would also be a part of the expansion program. Certificate of necessity has been granted on 50% of above amount.

. . . **Petroleum butadiene** will be used exclusively for synthetic rubber production in near future, according to Reconstruction Finance Corp. Agency said it plans to close its alcohol butadiene plants this summer, and may even put some petroleum butadiene plants on stand-by basis. RFC has ample supply of petroleum butadiene on hand, and also anticipates possible drop in demand for synthetic rubber as natural rubber prices fall.

. . . **Styrene monomer production capacity** (including methyl styrene) will be increased to 1.21 billion lbs. annually by Jan. 1, '55, under expansion program set up by DPA. Capacity on Jan. 1, '51 was only 626 million lbs. Of 584 million lbs. of new capacity needed, 24 million lbs. will come from expansion of government-owned plant, tax amortization certificates have been approved or recommended for approval on 558 million lbs., and two million lbs. is still to be provided for.

. . . **Synthetic glycerin** is being depended on for attainment of an increase of 53 million lbs. in annual glycerin output. Capacity of the industry in 1951 was 225 million lbs., and DPA has set a goal of 278 million lbs. of capacity by Jan. 1, '55. Since natural glycerin output is limited by availability of raw materials, DPA is counting on expansion of synthetic glycerin facilities to meet its goal. Shell Chemical is only producer of synthetic material at present, at its Houston plant.

Industrial Mobilization

. . . **End of accelerated amortization program** has been forecast by Defense Production Administration. Agency announces that when present industry expansion programs are completed there will be no more rapid tax amortization permitted. Issuance of amortization certificates will be continued, however, in those programs which have not yet been completed—which includes oil industry expansion.

. . . **Continued rise in avgas requirements** is forecast by PAD. At meeting with Military Fuels General Advisory Committee June 25, PAD reported it would be at least five years before avgas needs reach maximum and begin to be replaced by jet fuels. On current situation, PAD says avgas supplies will remain tight at least 12 months more.

. . . **Impact of steel strike** on refinery expansion has been light so far, but indications are that situation will worsen soon as inventories decline. Rough calculations showed that total steel losses this year by end of June were about 9,655,000 tons. Oil normally uses about 9% of total steel output, so its share of loss comes out to nearly 870,000 tons.

. . . **Copper supplies are loosening up**, as result of action of International Materials Conference in increasing amount which could be purchased abroad by U.S. firms. National Production Authority last month increased amount of copper domestic users will be permitted to purchase in third quarter by 16,000 tons/month.

. . . **More lithium is on the way** for the lithium hydroxide which grease compounders need for the multi-purpose greases the military wants. An expansion goal for the production of 10 million lbs. of lithium compounds annually by Jan. 1, '55 has been set up by DPA. Jan. 1, '51 capacity was 3,815,000 lbs.

Operations

. . . **Effect of recent oil strikes** will be to alter normal seasonal pattern of refinery operations during balance of '52. According to Robert E. Wilson, Indiana Standard board chairman, production of about 50 million bbls. of oil products was lost during strike—20 million bbls. of gasoline, 12 million bbls. of kerosine and distillate fuel oil, and 18 million bbls. of other products.

. . . **Increased crude runs will be needed** to make up the loss, Bureau of Mines reports, but Wilson doubts whether refinery runs can reasonably be increased more than 3 or 4% above the 94% of rated capacity run during first quarter '52.

. . . **Gasoline yields will have to be upped**, also, and here Wilson believes that 45.6% yield on crude runs as compared with average of 43.2% for third quarter '51 will be possible, in view of additional cracking and other facilities installed in recent years.

Markets, Prices

. . . **Steel strike hit heavy fuel oil markets** in June—and hit them hard. Coming on top of reduced industrial and ships' bunkering demands in coastal areas, and the rails' swing toward Dieselization, cessation of shipments to steel plants sent prices tumbling in the Mid-Continent and price shading was the rule in virtually all other refining areas.

. . . **Prices for other products held firm**, with exception of lubricating oils. Regular-grade gasoline was up 0.5c to low of 12.5c for barge lots at New York harbor, and, as June ended, Atlantic Coast suppliers were preparing to boost kerosine and heating oil prices 0.8c gal.

. . . **Highlights of the heavy fuel situation:** According to API statistics, inventories for the country as a whole actually increased—approximately 500,000 bbls.—while stocks of other products declined during the refinery strikes in May.

Reports from coal trade sources are that soft coal supplies above ground now are "mountainous" and prices "extremely cheap."

On sales for northern shipment, low reported quotation for No. 6 fuel, Group 3, was off 20c to $1.15 a bbl., to relieve bulging storage tanks, some refiners sold at $1.45, delivered Houston area, netting 75c a bbl. at refinery.

Announcing

The NEW ROCKWELL FITTING

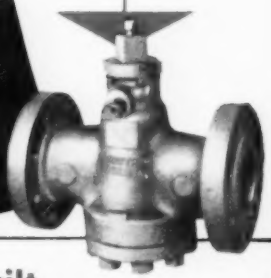
For Nordstrom Hypreseal Valves

A COMBINATION LUBRICANT SCREW AND GIANT BUTTON HEAD FITTING

NOW Nordstrom Hypreseal Valves Can Be Lubricated *WITHOUT INTERCHANGING PARTS* By These Three Methods . . .

To meet the growing demand for hand gun and bucket pump lubricating equipment, Rockwell Manufacturing Company has developed a new fitting for Nordstrom Hypreseal valves which is adaptable to any method of lubrication. Now furnished at no additional charge with all Nordstrom Hypreseal valves, the new fitting eliminates the bother and cost of purchasing giant button head fittings for hand gun or bucket pump lubrication. The new Rockwell fitting is also available as a separate unit to replace the lubricant screw on Nordstrom Hypreseal valves now in service. For further information contact your Nordstrom representative or write to Rockwell Manufacturing Company, 400 North Lexington Ave., Pittsburgh 8, Pa.

Now Standard Equipment on all Nordstrom Hypreseal Valves



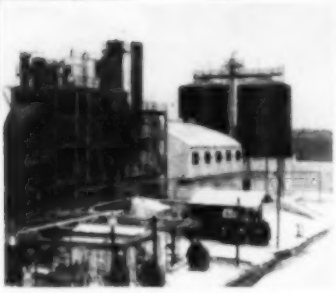
ROCKWELL Built

Another Rockwell Product

Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

GRAVER BINS
FOR CARBON BLACK



Equipped with the most modern processing machinery and centralized controls, this great plant of the Continental Oil Black Co. requires only 29 employees to produce annually 25,000,000 lbs. of high abrasion furnace black, which is marketed by the Witco Chemical Company to the rubber and paint industries. Utilizing gas, oil, process water and emergency steam from the nearby Continental Oil Refinery, the plant represents industrial planning of a high order and operating excellences of such a level that the highest quality products are produced.

A joint operation of the Continental Carbon Co. and the Continental Oil Co., this new plant of the Continental Oil Black Co. was engineered and built by United Engineers & Constructors Inc. of Philadelphia.

AT WITCO - CONTINENTAL'S NEWEST OIL BLACK PLANT IN WESTLAKE, LOUISIANA

Now producing high abrasion furnace black at the rate of 25,000,000 lbs. a year, this plant — the most modern in the industry — is the latest addition to the great petroleum and chemical installations in the Lake Charles area.

For this plant, Graver supplied the tankage for the oil feed stocks to be processed and the bins to receive the finished product. The pair of Graver-built bins, of cone roof and cone bottom design, each measure 30' in diameter by 38' 4" high with a total storage capacity of 1,500,000 lbs. of oil black.

In view of the high standards exercised by the Continental Oil Black Co. in the choice of equipment, Graver is pleased to have supplied the process tankage for this notable installation.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON • DETROIT
CINCINNATI • CATASAUQUA, PA. • HOUSTON • SAND SPRINGS, OKLA.

GRAVER

Fluorocarbons May Become Prominent Petrochemicals

FROM the field of fluorochemistry has been announced a commercial product of high potential importance to industry which stems basically from a natural gas or petroleum raw material. The M. W. Kellogg Co.'s KEL-F is described as "a strategic fluorocarbon-type plastic with extra-ordinary resistance to heat, moisture and chemical action." The reaction which produces it is a polymerization of fluorochloro hydrocarbons to high molecular weight material, the hydrocarbon in this case being ethane from natural gas. This development may represent an important excursion in a new phase of petrochemistry.

Plans for the production of KEL-F in expanded commercial volume have been made by the Kellogg Co., to more than 1,000,000 lbs. annually. The material had its origin in connection with the development of special corrosion-resistant materials for the Oak Ridge atomic energy plant and it has been produced in limited commercial quantities since 1947.

A wide range of applications for KEL-F and similar type fluorocarbons and fluorohalocarbons is seen in the electrical, food, packaging and wearing apparel industries and by the medical profession. Its potential as a lubricant is also believed high. These and other applications of this new product were discussed, in a recent demonstration in New York, in talks by Dr. W. E. Hanford, vice president of research and development for the Kellogg Co., and by Louis C. Rubin, manager of its chemical manufacturing division.

In the plastics field, it is believed this thermoplastic, because of its high heat resistance, will play an important role in the design and construction of such basic electrical equipment as refrigerators, air conditioning and television sets, by making it practical to operate their electric motors at higher temperatures and still adequately insulate them. In aviation usage it may take the form of an elastomer which will have the elasticity of rubber in a temperature range of −80° F. to +250° F. Because of its corrosion resistance, KEL-F or similar type fluorocarbons may also find use in containers for corrosive liquids, both chemicals and food products. Due to its low water absorption and chemical inertness, it is said to offer ideal material for the packaging of foodstuffs, and its low temperature properties make it suitable for deepfreeze operations.

In the field of lubricants, it was stated: "Because of the difference of the order of magnitude of the stability of this class of compounds as compared to the hydrocarbons, we visualize the possibility of preparing lubricants which have perfect properties such as stability to oxidation, low vapor pressure, high degree of oiliness and high viscosity index. This goal has not yet been achieved. We have achieved two or possibly three of these four properties, but we do not yet have a product with a good viscosity index.

"All that has been accomplished in the past 100 years in the field of organic chemistry has suffered from the limitation that the products are subject to the same oxidation degradation as those produced by nature. The same limitation has, to a lesser extent, existed in the metallurgical field except for the precious metals, gold and platinum.

"In the fluorocarbon field we have developed, for the first time, the counterpart of the precious metals with regard to their resistance to attack by the normal, natural phenomena. We can, therefore, expect great developments with these new building blocks in the next 10 or 20 years." —V.B.G.

Transistors, Electronic Industry's Most Interesting Child Prodigy

IS THE familiar vacuum tube on the way out in the field of electronics? The tiny new "flea-power" transistor, regarded by many authorities as one of the most important developments in that field since the vacuum tube itself, may well supply the answer to many of the tube's shortcomings.[1]

Essentially, the transistor performs the same function as the tube. One form, the point-contact type, consists of two hair-pin wires touching a tiny block of germanium to which is soldered a base contact. The entire apparatus is housed in a metal cylinder about the size of a .22 caliber shell. Another type, the junction transistor, has no point contacts. Instead, it consists of a tiny bar of germanium, treated so that it contains a thin electrically positive layer between two negative ends—all within a single piece of metal and then imbedded in hard plastic with wire leads to the three regions.

Flea power is literally correct too, and therein lies one of the transistor's advantages. When a vacuum tube is used to amplify a millionth of a watt signal, it consumes a full watt. According to Bell Laboratories (where transistors were invented) that is about "like sending a 12-car freight train, locomotive and all, to carry a pound of butter." The newest junction transistor can operate on about a millionth of a watt, just enough to carry the signal without waste.

Transistors are tiny. The junction type occupies about 1/400 cu. in.—about 1/50th the space required by a typical sub-miniature vacuum tube. This will permit very light weight, and small electronic equipment.

They don't heat up like vacuum tubes. Digital computing devices using them will suffer fewer "nervous breakdowns." Tube failures accounted for about 90% of the breakdowns in a large digital computer recently: in five months 5000 of the 18,000 tubes in the unit had to be replaced. Transistors are expected to have service lives up to 90,000 hrs. (10 years or more.

As improved substitutes for vacuum tubes, the transistor's future is bright. General Electric envisions almost completely automatic chemical plants as being much closer to reality because of the tiny devices, though their first and most immediate potential use is in electronic computers.

There are still a number of shortcomings to the transistor. Temperature effects limit their use above 70° C., as compared to about 500° C. for vacuum tubes. Also, they are generally low-power devices,

limited to handling power outputs up to 2 watts, except for laboratory units.

High purity is essential in their manufacture. Today transistors cost $15 to $20, but they're tough as nails to get. The military gets most of today's production, with some going into civilian telephone service. There are a number of makers, but so far transistors are being put together manually under microscopes. Daily output has been estimated at around 200 to 300. In four or five years, annual production of 5 to 10 million is anticipated by electronics industry people.

At any rate, when transistors do come in high volume, it seems safe to bet there will be a ready market for them.

—W.C.U.

(1) "What Can Transistors Do?" E. A. O'Connor, Chemical Engineering, May 1952, p. 124.

Liquefaction-Absorption Promising For Removing Nitrogen from Gas

NITROGEN in pipe line gas has been a concern of several years' standing to pipe line operators and natural gasoline plants alike. To the former nitrogen reduced the heat content of the gas, thereby line capacity in terms of Btu. Contract heat values cause the plant operator to leave in the gas some propane and butane otherwise salable at a higher price.

The gas industry estimates it could afford to spend from 1.5 to 2.5c per Mcf. to get rid of "excess" nitrogen, based on the anticipated increase in Btu. deliverable with existing facilities. ("Excess" nitrogen is defined as 10% or more, depending on circumstances of transmission and utilization. The equipment for its removal would have to handle from 100,000 to 700,000 Mcf/d. of gas. The American Gas Assn. asked the Bureau of Mines in 1947 to look into possible methods.

A report has just recently been published by AGA on possible methods reviewed in this cooperative study.(1) The report states there is no fully developed process for nitrogen removal or any that is readily adaptable. Only low-temperature separation (or fractionation) and adsorption methods hold any promise. Estimated processing costs by these methods will run from 2.5 to 3.5c.

The Bureau looked at four methods of low-temperature processing: single-stage separation, use of a stripping column, low-temperature fractionation and fractionation with pre-stripping. Pilot plant tests of low-temperature processing were conducted and data now are under study.

No tests apparently have been made of adsorption methods, reliance being upon published literature. The most feasible of these is Hypersorption or some modification employing a fluidized charcoal bed to reduce attrition losses.

Low-temperature processing already is well-represented commercially by production of oxygen and nitrogen from the air, but adaptation is complicated by the fact that serious losses could ensue were a residue gas consisting of a nitrogen-hydrocarbon mixture vented. Furthermore, ready markets might not be available for residue gas of such low heating value, even though the purified gas to pipe line was 99% hydrocarbons. Thus the ideal is a method producing high purity natural gas with a residue essentially nitrogen.

The studies point out another angle which might be used to off-set presently unfavorable economics. Refrigerate the wet-gas stream, simultaneously accomplishing dehydration while pre-separating LPG and natural gasoline, fractionate the remainder to split out nitrogen in high purity. For adsorption, employ two Hypersorbers or the equivalent in series, the first knocking out propane and heavier, the second adsorbing light hydrocarbons, leaving nitrogen to be vented or otherwise utilized.

Implication in the statement that pilot data on low-temperature processing are being evaluated is that a few big transmission lines taking gas high in nitrogen might find it profitable to get into the LPG and natural gasoline business. The alternative is to make it worth-while for any involved natural gasoline plant to discard present absorption methods and resort to liquefaction techniques on a scale hitherto unheard-of.

Unfortunately, low-temperature methods require liquefaction of the entire gas stream, making costs heavy, and the plant will have to find some way to dispose of nitrogen without excessive "shrinkage" resulting from any inclusion of respectable quantities of hydrocarbons in the residue. The authors of the A.G.A. report apparently believed such a combined operation may make an otherwise uneconomic "treating" process profitable.

—D.P.T.

(1) "Prospective Methods and Estimated Costs for Removing Excess Nitrogen from Natural Gas," by P. V. Mullins, Bureau of Mines and R. W. Wilson, formerly of the Bureau and now with Panhandle Eastern Pipe Line Co. (Project NG10-6, a cooperative project of A.G.A. and Bureau of Mines, published by A.G.A.)

French Hot Extrusion Method May Make Better Alloy Tubes Available

METALS such as molybdenum and some of its alloys, titanium, and certain of the stainless steels all have good potential applications for severe service conditions in equipment for the petroleum and chemical processing, power generation, and atomic energy industries. Unfortunately, they are difficult to forge and sometimes impossible to pierce economically for making tubing or other useful equipment shapes.

Not too long ago, the so-called Ugine-Sejournet process was developed in France for making tubing by extrusion. A number of American manufacturers have now obtained licenses to use this process. The first, full-scale equipment using the extrusion method for unpierceable metals has been installed by Babcock & Wilcox Co. at their Beaver Falls, Pa., plant.(1)

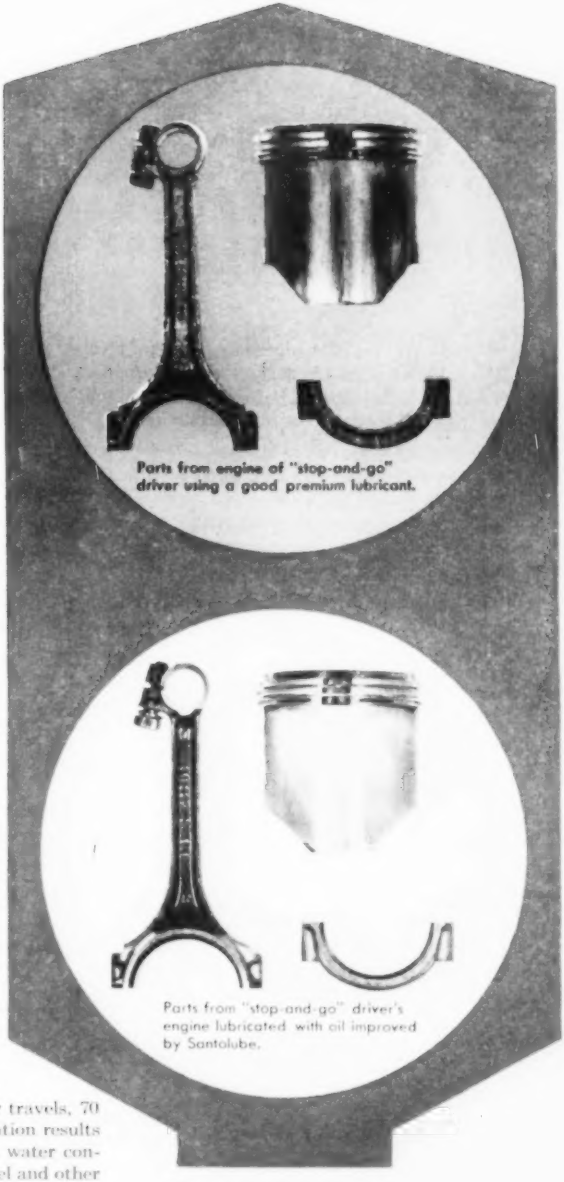
With this new equipment a white hot billet of selected metal, 28 in. long and 8 in. in diameter, can be extruded—or "squeezed out" like toothpaste—into a 60-ft. tube 2 in. in diameter in less than five seconds. A die and mandrel form an annular aperture through which the metal is forced to make the tube. Solid bars can be extruded simply by omitting the mandrel.

Speed of manufacture is not the principal advantage of the process, of course. The possibility of obtaining heretofore unobtainable alloy tubing should be of interest and value to the petroleum and petrochemical processor.

—W.C.U.

(1) Announcement dated June 9, 1952, Babcock & Wilcox Co.

Santolubes solve problem in "stop-and-go" driving



Parts from engine of "stop-and-go" driver using a good premium lubricant.

Parts from "stop-and-go" driver's engine lubricated with oil improved by Santolube.

Of every 100 miles that the average passenger car travels, 70 to 85 miles are "stop-and-go" driving. Such operation results in organic acids that cause high engine wear . . . water condensation that brings rust . . . partially oxidized fuel and other contaminants that build up deposits throughout the engine and cause excessive wear and oil consumption.

This problem of the "stop-and-go" driver can be solved by improving lubricants with Monsanto Santolube 388.

Compounding lubricants to fill the needs of "stop-and-go" driving is a joint project of the compounder and additive supplier. Why not let Monsanto help you? For complete details on the use of Monsanto Santolubes for "stop-and-go" driving, get in touch with MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

SANTOLUBE

MONSANTO
CHEMICALS – PLASTICS

Serving Industry Which Serves Mankind

Santolube Reg. U. S. Pat. Off.

(To obtain more data on advertised products see page 1052)

Now, from Honeywell... *a flow*

Wherever supervision of your plant processes requires flow measurement, Honeywell has the right instrumentation for the job.

Included are instruments specifically designed for accurate metering and flow cost accounting of process fluids, with either linear or square root scales and continuous integration . . . with a choice of electric or pneumatic transmission from the metering point.

Flow-measuring systems, including proper control, are patterned to your exact requirements . . . offer you the advantages of Honeywell's single responsibility from sensing element to control valve. Each part of the system is designed and built with the needs of process designers, production engineers and instrument men foremost in mind.

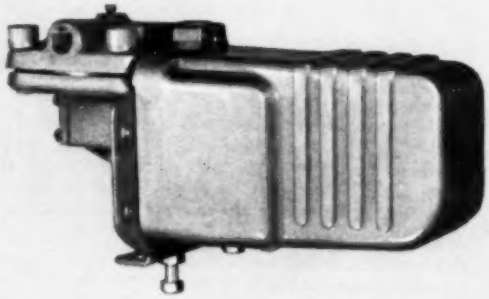
Call in our local engineering representative for a discussion of your application . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4582 Wayne Ave., Philadelphia 44, Penna.

BROWN DIFFERENTIAL CONVERTER

This new flow transmitter, based on the pneumatic balance principle, is setting high standards of precision and simplicity in field operation. Using no mercury, seals or strainers, it converts the pressure differential at the metering orifice into a proportionate air output pressure which is a measure of flow. Response is rapid and accurate. Range is continuously adjustable from 20 to 200 inches of water, and is easily changed in the field without special tools or extra parts. Applicable to either liquids or gases, the Differential Converter is easily installed, cleaned and calibrated in the field.

For graphic panels and other applications requiring compact instrumentation, the Differential Converter is part of a new Honeywell flow control family which includes Tel-O-Set Indicators, Recorders and Controllers. Write for *"Centralized Instrumentation—Unlimited,"* a new brochure describing types of Brown panelboards and instrument components available for industry.



● *Important Reference Data* . . . Write for Catalog No. 2281 on the Differential Converter...

meter for every requirement

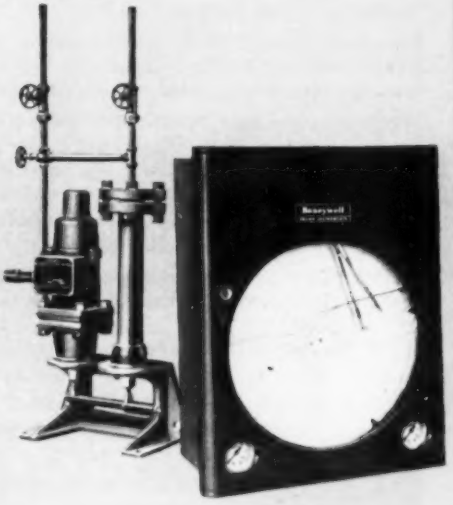
BROWN EVENLY GRADUATED FLOW METER

Costs for distribution and utilization of fluids can be accurately determined with this meter . . . available as a mechanical meter (with integral meter body) or as an electric meter (with electric transmission from remotely located meter body).

Features linear scale and electronic integration for simplified flow accounting. Electronic integrator is simple, accurate and easily accessible for calibration and inspection. Characterized corrosion-resistant bell automatically provides straight-line flow measurement.

BROWN SQUARE ROOT FLOW METER

This instrument's expanded, square-root scale affords extra sensitivity for automatic flow control applications. Available with on-off, throttling or Air-O-Line (proportional plus automatic reset) pneumatic control . . . Supplied for use with electric or mechanical meter bodies, in a wide choice of types: low pressure, intermediate pressure and all-purpose—plus sealed armature and area types for special fluids. Interchangeable range tubes afford broad flexibility in the field.



MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Catalog No. 293-1 on the Evenly Graduated Flow Meter... Catalog No. 2022 on the Square Root Flow Meter.

Drop Forged Steels

W-S Screw-End and Socket-Weld Fittings

That's right, W-S emphasizes the *plural* when it comes to the various steels for forged fittings.

From Monel down to the full range of carbon types, including low sulphur and phosphor-controlled grades, W-S *forged* fittings spark the trend toward specialized materials for specialized needs.

What's your problem? STRENGTH? W-S is a leading supplier to the high-pressure, high-temperature power industry. CORROSION? W-S stainless and alloy fittings tie America's main arteries of chemical production. SANITATION? W-S is a big producer of the popular Type 304 for food and pharmaceutical operations. Low temperature? Another W-S specialty.

And there's one problem common to all . . . COST. Let us show you how W-S *forged* fittings provide the lowest *service* cost obtainable.

• Stronger • Smaller • Lighter • Tighter
• More Uniform • Lower Service Cost

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

WATSON-STILLMAN
ESTABLISHED 1848

DISTRIBUTOR PRODUCTS DIVISION
ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

(To obtain more data on advertised products see page 1032)

Letters

Decimal Moved

I would like to call your attention to an error in the reference to the potential of the perimeter of the 80,000-bbl. tank on the first test (in the Plant Practices item "Stop Tank Bottom Corrosion with Cathodic Protection" in May, p. 659). In my paper I had 1200 to 1500 m.v., which would be 1.2 to 1.5 volts instead of 0.12 to 0.15 volts as you have it.

LOUIS A. SNYDER
Electrical Engineer
Long Beach, Calif.

Reader Snyder is right. An overzealous editor pushed the decimal point one place too far in converting millivolts to volts.

What's a Petrochemical?

I was very much interested in the recent article "What Is a Petrochemical?" by William F. Bland (April issue, p. 490) because I have been actively engaged recently in discussions of the proper nomenclature for chemicals recovered or derived from petroleum or natural gas.

I must differ sharply with Mr. Bland's statement that any attempt to change the usage of the term *petrochemical* in this sense is ridiculous. I have pointed out numerous published instances of the use of the terms *petrochemistry* and *petrochemical* in the proper sense, the chemistry of rocks, that antedate by many years the earliest use of these terms in the other sense. Thus, the proper usage has not only etymology but also priority on its side.

I agree with Mr. Bland that terms like *petrolchemistry* might be confusing because of the special meaning of *petrol* as *gasoline*. He appears quite as positive, however, that no other change should, or can, be made. I respectfully invite your attention, and his, to the fact that *petrolochemistry* has only one letter more, that this change could, by agreement, be quite simply and easily made, and that the result would be to eliminate one of the unfortunate situations in the English language where two words with identical spellings have widely divergent meanings.

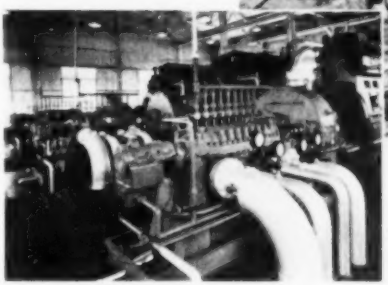
This suggestion (*petrolochemistry*, etc.) has received the sympathetic attention, including indication of willingness to adopt these terms and support them, if agreement of enough individuals concerned can be obtained, of such men as Austin M. Patterson, Chairman of the Committee on Nomenclature of the Division of Chemistry and Chemical Technology of the National Research Council; L. M. Roberts, Manager of Manufacturing Operations of Shell Chem-

When your need is the economical transfer of liquids from one location to another . . .

Specify **PUMPS REFINED FOR YOUR SPECIFIC SERVICE BY**

Pacific

You will not see all the refinements—some are hidden—But you will see all the economies effected by Pacific's refinements.



▲ Vertical Pumps Refined for A Special Service by Pacific

◀ Horizontal Pumps Refined for A Specific Service by Pacific

You will not see:

* the balanced proportions of the heavy sections or the quality of the selected materials of construction that insure extra strength with extra allowance for corrosion
* the dynamic or the hydraulic balance that eliminates vibration
the precision workmanship and finish that insure perfect fit for all parts

You will see:

* curves outlining liquid passages formed and proportioned for high efficiency streamlined flow without turbulence, destructive cavitation or erosion

★ IN YOUR MONTHLY STATEMENTS AN OUTSTANDING RECORD OF AVAILABILITY—RELIABILITY—LOW COST FOR OPERATION AND MAINTENANCE

PACIFIC *Precision Built* **PUMPS**

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES
HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities
PP-15

(*To obtain more data on advertised products see page* 1032)

YOU CAN *Save* IN TOWER AREA, HEIGHT, AND FOUNDATION COSTS WITH . . .

KOCH VENTURI -type KASKADE TRAYS

SAVE 23% TO 50% IN TOWER AREA

VENTURI VAPOR PASSAGE GIVES LOWER PRESSURE DROP . . .

SAVE UP TO 30% IN TOWER HEIGHT

SAVE UP TO 20% IN FOUNDATION COSTS

Let us PROVE how you can save thousands of dollars in tower costs, and still obtain higher capacities and efficiencies. Bulletin No. 629 illustrates how others have accomplished these results; write for it today.

KOCH ENGINEERING COMPANY, INC.

DESIGNERS • MANUFACTURERS • BUILDERS

321 WEST DOUGLAS • WICHITA 2, KANSAS

Eastern and Export
30 Rockefeller Plaza
New York City

Pittsburgh, Pa., Repr.
D. D. Foster Co.
412 Peoples Gas Bldg.

Tulsa, Okla., Repr.
Myers-Bogwell Co.
Wright Bldg.

British Associates:
Messrs. A. F. Craig & Co., Ltd.
Paisley, Scotland

ical Corp., Walter J. Murphy, Editor of *Chemical & Engineering News*, and others.

Mr. Bland's article indicates that there is practical unanimity of opinion, not only in science and industry, but also among lexicographers, as to the appropriateness and desirability of the change. I insist that by agreement among a comparatively few individuals and organizations that the change *can* be made and that it should be made now to eliminate the ambiguity that has arisen.

I shall appreciate it very much if you can see your way clear to support this change and to give it publicity so that if the change is to be made it can be made as rapidly and completely as possible.

EARL INGERSON
Chief
Geochemistry and Petrology Branch
Geological Survey
U. S. Dept. of Interior
Washington, D. C.

• . . . You state that "our viewpoint is that the word has been so widely established through popular usage that any controversy on its propriety and any attempt to change it are ridiculous." I am in complete agreement with you. The usage of *petrochemical* to mean "relating to the chemistry of rocks" is not only etymologically sound, but has the sanction of a century of continued and continuing usage by chemists the world over. We who are interested in the chemistry of rocks have no intention of abandoning a good and properly used word in favor of an erroneous usage less than ten years old, and the attempt to force such a change is ridiculous.

The only way that confusion can be avoided is for the petroleum industry to abandon a term that even its strongest proponents must admit is incorrect.

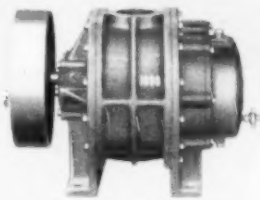
MICHAEL FLEISCHER
President
Mineralogical Society of America
c/o U. S. Geological Survey
Washington, D. C.

• This letter is written in an effort to enlist your support of a rapidly growing movement on the part of many leaders in the field of chemistry to insure that the chemical literature of the future will not contain the word *petrochemical* erroneously used, as is found in the article by W. F. Bland . . . The trade-mark laws protect us against just this condition in the naming of salable products. Outside of this realm we have only the force of public opinion to turn back those who care so little about correct nomenclature. . . .

JOSEPH J. FAHEY
PRESIDENT
Chemical Society of Washington
c/o U. S. Geological Survey
Washington, D. C.

For 10 CFM or 100,000 CFM ...compare blower values

ROTARY



Typical low-capacity R-C Rotary Positive Blower. Sizes range from 5 cfm to 50,000 cfm, permitting selection closely matched to needs.

- ☐ Choice of Rotary or Centrifugal
- ☐ Capacity matched to the job
- ☐ Easy accessibility
- ☐ Ruggedness
- ☐ Ease of installation
- ☐ Ability to handle overloads
- ☐ Long-time durability
- ☐ Freedom from breakdowns
- ☐ Low maintenance costs
- ☐ Engineering assistance
- ☐ Proved reputation of maker
- ☐ Customer satisfaction

No need to take chances when buying blowers, exhausters or gas pumps. Just put this "detector test" to work on your specific problem and you'll arrive at the most satisfactory answer.

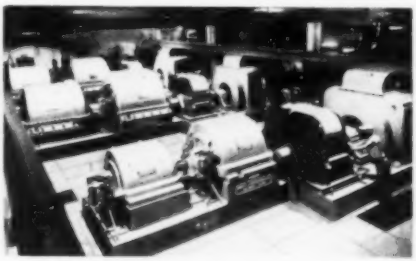
For instance, if you're debating between Rotary Positives and Centrifugals, remember that only Roots-Connersville builds both—the exclusive *dual-ability line* that permits unbiased recommendations. Their wide range of capacities supplies sizes and types that are quite likely to be most closely matched to your needs.

For economy of operation, reliability and low maintenance, we refer you to a list of users that dates back almost a century. If you'll rate your possible choices on a performance basis, you'll usually find R-C equipment "tops" on the list.

To help you make the most profitable, practical decision, our experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
525 Texas Avenue, Connersville, Indiana

CENTRIFUGAL



Six R-C Multi-Stage Centrifugal Blowers equipped with automatic regulators to provide extremely wide range of operation at various pressures and capacities.

ROOTS-CONNERSVILLE BLOWER

BLOWER BUILDERS SINCE 1854

A DIVISION OF DRESSER INDUSTRIES, INC.

(To obtain more data on advertised products see page 1052)

FISCHER & PORTER

P-4

PNEUMATROL

the 1st

Flexible, die-cast building-block construction—six modes of control; right or left or dual case mounting, or point-of-measurement mounting.

High capacity (1.8 SCFM), non-bleed relay valve.

Double slack diaphragm design eliminates dead space and critical relay adjustment.

Large integral air passages permit maximum response, eliminate piping.

Accessible capillary restriction and integral filter.

Differential input assembly is an integral part of controller, assuring tracking.

Rugged, self-aligning "Barrel-Bearings"—eliminate friction.

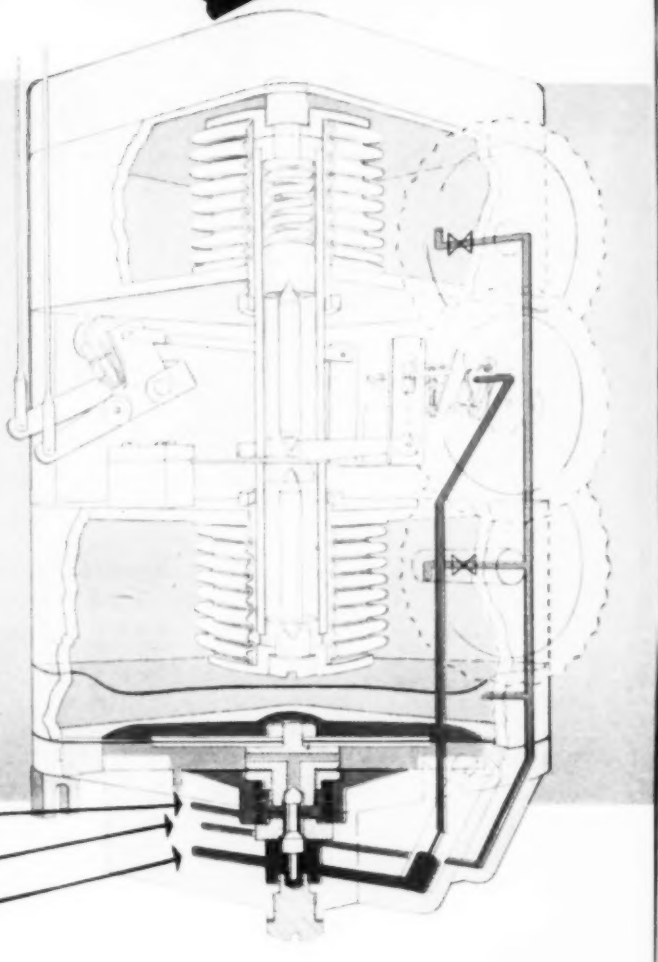
Jewel-mounted stainless steel flapper, rotatable around fixed stainless steel nozzle for proportional band adjustment and reversal of action.

Self-aligning, rigidly-coupled bellows assembly.

Beryllium-copper flexure spring, pivot-pin coupled to bellows without backlash or side thrust.

Long-path adjustable resistor valves for reset and derivative, O-ring sealed, non-jamming, calibrated 0.02—5 min. or 0.2—50 min.

Independent derivative vibration stabilizer; pneumatic balance action.

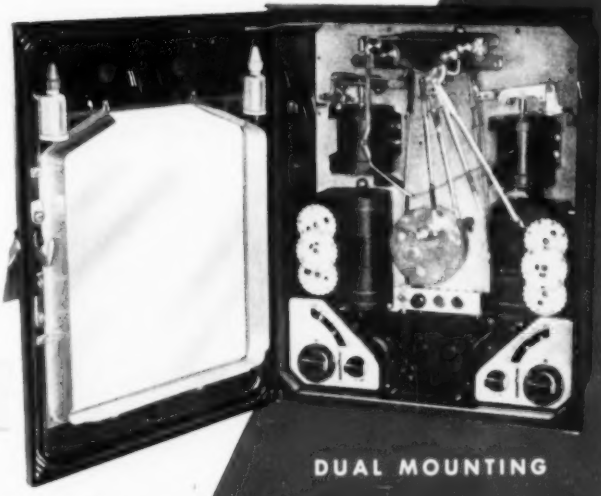


ALL PURPOSE Pneumatic Controller

for either instrument or point-of-measurement mounting

for
- rate of flow
- pressure
- differential pressure
- temperature
- liquid level
- viscosity

The P-4 Pneumatrol is the *first* controller suitable for point-of-measurement installation as well as either single or dual case mounting. Knowing more about the many uses of the P-4 may lead to closer control of your processing operations. Get all the data NOW. The convenient coupon will bring you full information by return mail. Send for it while the subject is fresh in your mind.



The P-4 incorporates both proportional and derivative actions with automatic reset response for precise positioning... in stacked units, as shown in this transparent model.

For pneumatic-set, point-of-measurement control for use with graphic panels and miniature instruments, particularly where transmission lag must be eliminated for perfect control. Shown here mounted on the popular F & P 52 OK pneumatic transmitter.

FLOWRATOR

DUAL MOUNTING

- Complete mounting of transfer switch and regulator within the case.
- Greater panel space economy.
- New die-cast aluminum case and door.
- All accessories visible through door.
- External knobs for instant manual operation.
- *Everything* is inside the case, eliminates external manual panels.

FISCHER & PORTER COMPANY

1170 COUNTY LINE ROAD, HATBORO, PENNA.

Please send me by return mail complete specifications on your new P-4 Pneumatrol.

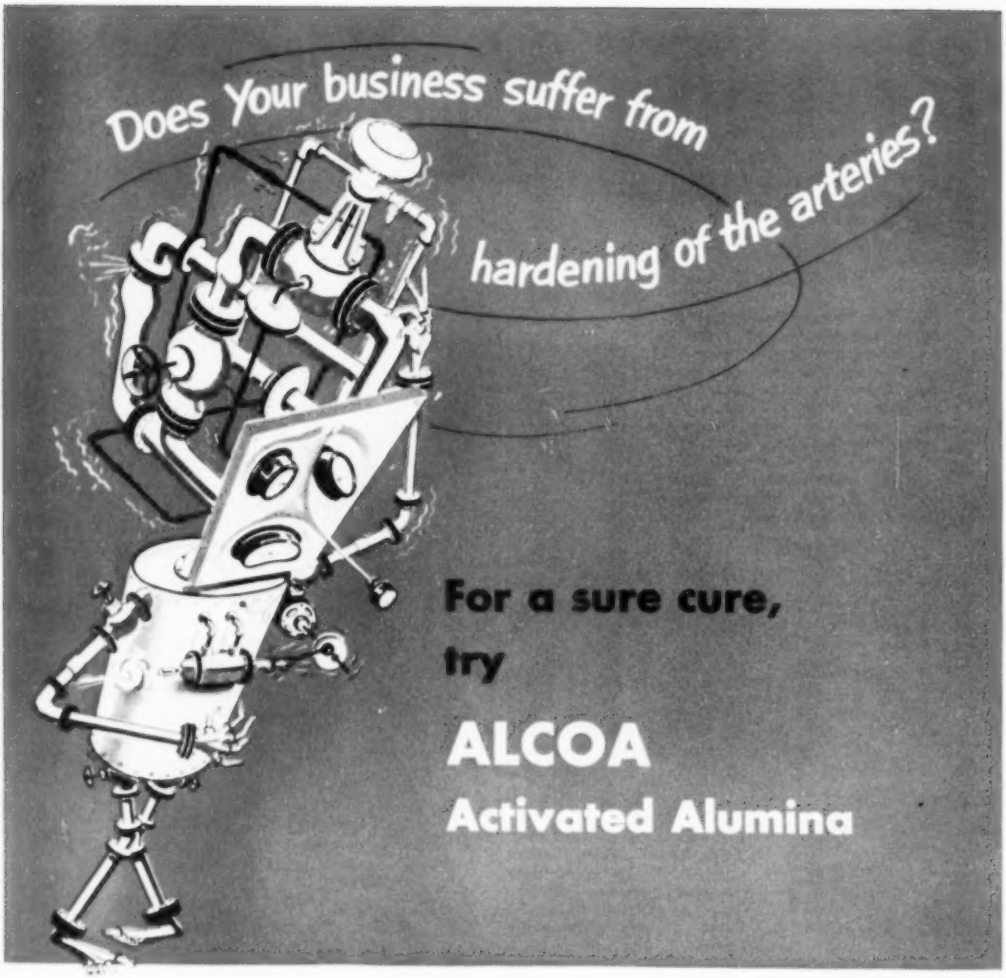
NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

CITY & STATE_____



If the compressed air in your automatic instrument and process-control lines holds moisture, rust or oil, your business has "hardening of the arteries." Instrument readings can go haywire . . . air-line valves can stick . . . controls can be faulty . . . almost anything can happen . . . and it all costs money!

It's unhealthy economics to install an elaborate remote process control system and then not keep the pressure air *clean* and *dry*. Dry air *can't* freeze . . . *can't* form rust! That's why the ALCOA Activated Alumina cure is so effective. This reliable desiccant works efficiently to prevent moisture and oil from entering the system.

ALCOA Activated Alumina is abundantly available for your dehydrating system. Numerous manufacturers can supply you with drying equipment using ALCOA Activated Alumina.

Thorough conditioning of air with ALCOA Activated Alumina puts new life into process-control systems . . . reduces maintenance and operating hazards. Write us today for details.

Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 616e Gulf Building, Pittsburgh 19, Pa.

Don't forget UTILITUBE. ALCOA's instrument air-line tubing in long lengths.

Alcoa Chemicals

ALCOA ALUMINAS and FLUORIDES

A New Achievement

.... in simplified, automatic Tank Gauging

"Varec" FIGURE NO. 2500 AUTOMATIC **TANK GAUGE**

FOR ALL TYPES OF LOW PRESSURE TANKS
READINGS UP TO 70 FT.

"VAREC", a pioneer in the development and manufacture of automatic tank gauging equipment has applied new fundamentals of design and operation to the Figure No. 2500 Gauge for the ultimate in accurate liquid level reading and dependable, trouble free operation.

Representing a major improvement with this new concept of simplified automatic tank gauge design, the "VAREC" Figure No. 2500 now utilizes the revolutionary Neg'ator Motor (Pat. No. 2,063,700) housed within the gauge head, to maintain a predetermined constant tape tension. This eliminates the need for a conventional counterweight.

Here's a Look Box You Can Read Easily, Accurately!

(Shown approximately ⅝ actual size)

EASIEST TO INSTALL because:
Both counterweight and counterweight pipe have been eliminated. This permits installation of the look box at any desired height from the ground or on top of tank.

EASIEST TO READ because:
Full view Counter in the Look Box for quick, accurate reading of foot increments and a dial for reading inches and fractions. Use of large distinct numerals minimizes chance of reading errors. Eliminates calibrated tape.

EASIEST TO OPERATE because:
"VAREC" patented Gravity Compensator (Pat. No. 1879805) is incorporated with "inch reading" dial. An external Gauge Check device (Pat. No. 2555593) permits manual checking of gauge operation when desired.

EASIEST TO MAINTAIN because:
All internal parts of the Figure No. 2500 Look Box are non-sparking in contact with each other.
Non-corrosive Graphitar tape sheave bearings — self lubricating.

The "VAREC" Figure No. 2500 Automatic Tank Gauge is gas tight. It is adaptable to all types, arrangements and installations of low pressure tanks up to 70 feet in height. "VAREC" Figure No. 2500 Gauge Head is available as a separate unit and can be installed on existing float operated type tank gauges utilizing ½" wide tape sheaves.

Provision has been made on the Look Box housing for installation *at any later date* of a "VAREC" Electronic Remote Reading Gauger Transmitter for use in conjunction with the various models of "VAREC" Electronic Gauger Receivers.

If you are not yet realizing the many time and money saving features and advantages of automatic tank gauging in your operations, install this new, simplified "VAREC" Figure No. 2500 Automatic Tank Gauge and start out ahead. Write or call your nearest "VAREC" Representative for all the facts.

"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 N. Alameda Street, P. O. Box 231
Compton, California, U.S.A.

MAIL COUPON NOW FOR NEW BULLETIN CP-3500

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 N. Alameda Street, P. O. Box 231
Compton, California, U.S.A.

Dept. _____

Name _____ Title _____

Street and No. _____

City and State _____

Straight-Line Flow... the economical path from fresh feed to product...

Orthoflow, the new streamlined Fluid catalytic cracker by Kellogg, brings new flexibility and economy to petroleum processing.

In the **Orthoflow** single-vessel units, transmission lines for both catalyst-oil mixture and spent catalyst are fewer, shorter and straight . . . slide valves and expansion joints are eliminated . . . the catalyst transmission system completely streamlined. Erosion is minimized, maintenance brought to a new low and flexibility of operation retained.

Orthoflow can handle practically any feedstock, from kerosene to the heaviest gas oils. High-boiling stocks are charged as liquids and vaporized by regenerated catalyst with minimum use of preheat facilities.

Orthoflow also permits wide latitude in conversion, recycle, and feed rates.

In this simplified Fluid cracker design, Kellogg engineers have achieved significant savings in original investment. With both reactor and regenerator incorporated into a single vessel, **Orthoflow** saves steelwork, saves on foundations, saves piping . . . and saves thousands of manhours too.

PROGRESS REPORT
ORTHOFLOW CATALYTIC CRACKERS

UNITS OPERATING:

In Western Canada—	2,500 BPD Unit
In Mid-Continent U. S.—	8,300 BPD Unit
In Eastern Canada—	8,300 BPD Unit

UNITS UNDER CONSTRUCTION:

On the Atlantic Seaboard—	28,000 BPD Unit
In Mid-Western U. S.—	17,000 BPD Unit
On the Gulf Coast—	26,000 BPD Unit

Kellogg Orthoflow

THE CRACKER WITH STRAIGHT-LINE CATALYST FLOW

SIMPLICITY, the outstanding characteristic of **Orthoflow** and the ultimate in any field of design, is the logical outcome of Kellogg experience in Fluid catalytic cracking . . . which dates from the inception of the process and includes the engineering of 70 percent of the world's total fluid capacity. Details of this important new development in Fluid cracking are presented in Kellogram No. 1—1952 Series "From Baton Rouge to Orthoflow". If you haven't received it, we'll be glad to send a copy on request.

THE M. W. KELLOGG COMPANY

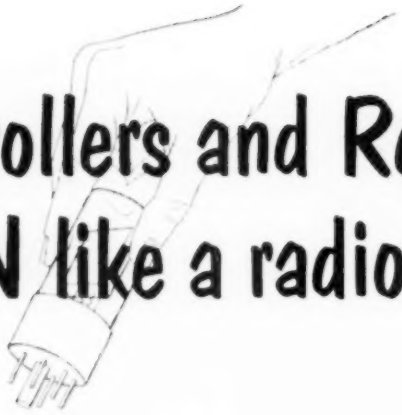
(A Subsidiary of Pullman Incorporated)

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

KELLOGG

. . . . . for fifty one years an integral part of petroleum refining progress!

Both Controllers and Receivers PLUG IN like a radio tube



. . . . . in Taylor's NEW Transet Control System

HERE'S a new and greater TRANSET Pneumatic Control System! It incorporates all the superior control features and control accuracy that has made TRANSET 4-part control such an overwhelming success since its introduction. Now we have *added* all these *new* benefits:

1. **All units** can be mounted on the panel without welding, without drilling holes.

2. **A single mounting** is all you need for both controller and recorder or indicator.

3. **You can change** from simplest to most complex control as easily as changing tubes in a radio, simply pulling out one unit, plugging in a new one.

4. **You can change** from indicator to recorder, or vice versa, the same way—in only 10 seconds.

5. **The only piping connections** required are air supply, controller output and to the variable transmitter. All other connections are made automatically, in the self-sealing manifold.

6. **You save panel space,** because units can be mounted only a few inches apart.

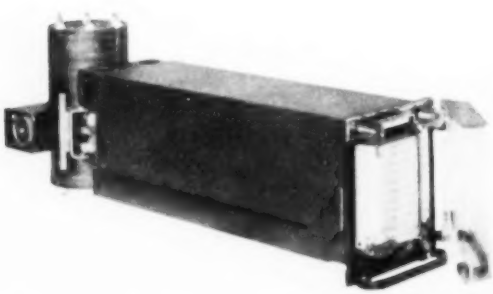
7. **You save money,** both in labor and materials on installation—thanks to the simplified piping and mounting.

8. **All adjustments** on the recorder or indicator can be reached conveniently, from the front, without disturbing any connections.

9. **Mountings are so rugged,** attach to panel so sturdily, that they would support the weight of an average man.

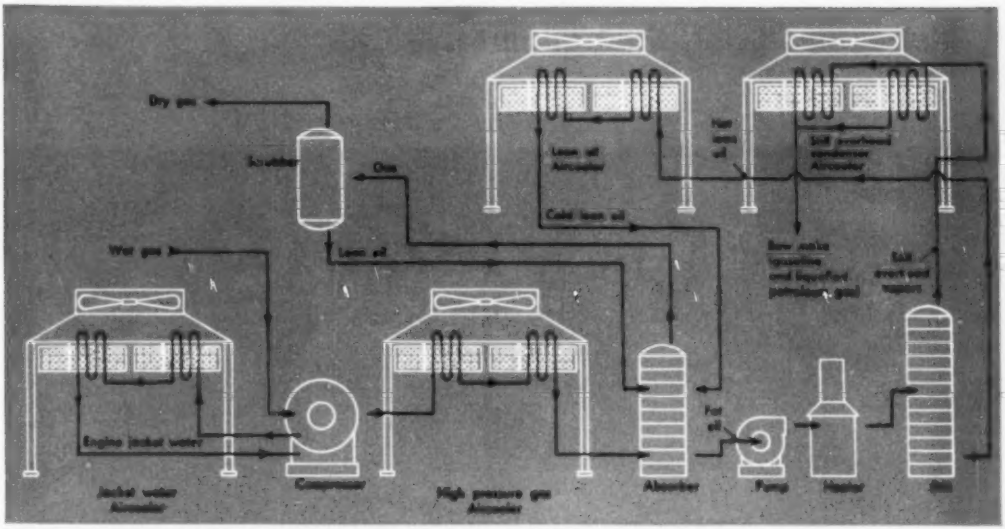
All these features, and many more, have been added to the famous Taylor TRANSET Control System. Before you make any decision involving pneumatic transmission control, be sure to get information on the new and greater plug-in type TRANSET Control. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.



Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

- cooling engine jacket water
- cooling high pressure gas
- condensing overhead vapors
- cooling lean oil



versatile ALCO AIRCOOLERS handle all these cooling duties at natural gasoline plants

ALCO Aircoolers demonstrate their versatility in natural gasoline plants. The simplified flow diagram above shows how Aircoolers are used to cool jacket water, cool high pressure gas, condense overhead vapors and cool lean oil.

The flexibility of ALCO fabricated steel header design also permits handling a number of different fluid streams in one tube bundle. For example, in some installations a single Aircooler may perform both the lean oil cooling and overhead vapor cooling functions.

ALCO Aircoolers are the logical and economical solution to all types of cooling problems where abundant good water is not available. Scale and corrosion troubles are eliminated.

For details call your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Los Angeles, New York or Tulsa.

Send Coupon for ALCO Aircooler Bulletin.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Plants: Dunkirk, N. Y. • Beaumont, Texas

***In step with tomorrow*— ALCO Aircoolers, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**

ALCO PRODUCTS DIVISION E
AMERICAN LOCOMOTIVE COMPANY
Schenectady, N. Y.

Gentlemen:
Please send me the ALCO Aircooler Bulletin.

Name Position

Company

Address

City Zone State

(To obtain more data on advertised products see page 1032)

...again in '52

NATIONAL PETROLEUM NEWS
Oil Industry's $10 Billion Expansion Program
Outlook For Steel Is Good—P. 33
Labor Battles Could Cripple It—P. 38
IN THE MERCHANDISING DIVISION
first award
TO NATIONAL PETROLEUM NEWS
FOR BEST SERIES OF ARTICLES
ABP
ABC
PETROLEUM PROCESSING
including Petrochemical Processing Section
MAY 1952
Is Specialized Engineering Needed?
Progress in Petrochemicals
New Fractionator Tray Design
Automatic Sulfur Recovery Plant
IN THE INDUSTRIAL DIVISION
award of merit
TO PETROLEUM PROCESSING
FOR OUTSTANDING SERIES OF ARTICLES
NBP
SEA

Platt Petroleum Publications capture awards for outstanding editorial performance...

Once again, Platt Petroleum Publications gain high honors for editorial achievement and excellence as both *National Petroleum News* and *Petroleum Processing* are named winners of 1952 Industrial Marketing Awards.

Back of these prize-winning performances is an exciting story of editorial alertness and industry service. Platt Petroleum Publications have been growing up with the oil industry through nearly a half century of service. From a single publication, this service has expanded to one weekly magazine, one monthly magazine, three daily bulletin services, as well as annual handbooks and directories.

The editorial potential of Platt Petroleum Publications in trained manpower and extensive facilities is matched by few business publishing organizations. It is concentrated on the specialized interests of one of the world's greatest and most dynamic industries. The field contacts and flow of information throughout the organization materially benefit each specialized publication in the group.

Platt Petroleum Publications are the oil industry's primary sources for news, product prices, manufacturing technology and marketing know-how. Today, 29 full-time editors, reporters and feature writers—plus their supporting staffs—are in constant daily contact with the oil industry. They operate from six editorial bureaus, strategically located in Washington, New York, Cleveland, Chicago, Houston and Los Angeles. More than 2400 miles of privately leased teletype wire facilities, supplemented by long-distance telephone, speed the transmission of their reports to copy desks in Cleveland and New York.

The editorial columns of Platt Petroleum Publications have become established as authority in thousands of cases where personal opinions may have differed. The sales of billions of gallons of oil and its by-products have been completed on the basis of prices quoted on the printed page. Major policy decisions of oil companies have been aided because of fast reporting on ever-changing government directives. Quotes from important stories have been voiced everywhere from directors' meetings to the halls of Congress.

That this editorial investment pays off in oil industry service and reader interest is clearly evident. More than 82% of *National Petroleum News*' oil marketing readers renew their annual subscriptions. More than 94% of *Petroleum Processing*'s refining and petrochemical readers request continuation of their names on its controlled circulation list each year.

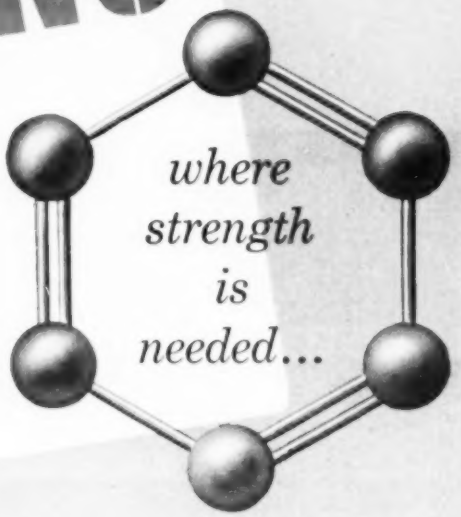
Advertisers can capitalize on the unusually high reader values resulting from the editorial investments in Platt Petroleum Publications. To sell management and marketing men of the petroleum industry, it's *National Petroleum News*. To sell refining and petrochemical men, it's *Petroleum Processing*.

Platt Petroleum Publications

NATIONAL PETROLEUM NEWS . . . PETROLEUM PROCESSING
OILGRAM NEWS SERVICE . . . OILGRAM PRICE SERVICE . . . OIL-LAW-GRAM
OIL PRICE HANDBOOK . . . TBA DIRECTORY

1213 West Third Street, Cleveland 13, Ohio
Sales Offices in New York, Chicago, Philadelphia, Houston, San Francisco and Los Angeles

STRONG



where strength is needed...

The Lummus Company has played an integral and important role in the unfolding story of chemical progress.

Evidence? You'll find it all over the globe in the form of chemical processing units designed, engineered and constructed by The Lummus Company—plants whose initial run met or exceeded design capacity and never relaxed in performance.

Examples? Lummus has designed and built nearly 350 chemical processing units, included among which are plants for producing phenol, resins, solvents, asphalts, alcohol, acetone, toluol, ammonium picrate, and for manufacturing catalysts. We were at the forefront in providing huge styrene and butadiene plants to feed the vast synthetic rubber program. In providing ethylene manufacturing facilities, the name Lummus looms biggest of all.

May we suggest our symbol as a good one to look for, believe in, and rely on in connection with your next chemical processing project? You'll find us to be a group with the depth of chemical engineering talent and the breadth of experience to tackle engineering and construction problems anywhere in the world.

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

HOUSTON • CHICAGO • LONDON • PARIS • CARACAS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

Now! Filter anything from Air to Zynol...

VISKON HAS HIGH POROSITY!

Matches the high porosity of ordinary filter fabrics of the same weight—does the job as good or better than the best!

VISKON HAS HIGH FLOW RATE!

Actually exceeds the flow rate of similar weights and grades of many woven cloth or paper filters.

VISKON RESISTS DETERIORATION!

Last longer under severe filtering conditions—ideal for use in high alkali solutions and for petroleum products.

VISKON IS STRONG WHEN WET!

A big advantage over paper filters! Viskon's high wet strength means longer filter life, greater dependability!

VISKON IS AVAILABLE IN WIDE VARIETY OF SIZES, WEIGHTS!

There's a Viskon filter fabric made for nearly every filtering purpose. Information concerning special applications can be had on request.

VISKON® nonwoven fabrics

—another product to fit today's needs by

THE VISKING CORPORATION
NORTH LITTLE ROCK, ARKANSAS

... Faster, Better and at Lower Cost—with new

VISKON® nonwoven filter fabric

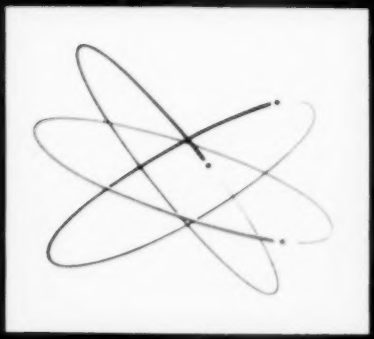
Many VISKON users tell us every feature you've ever wanted in a *better* filter is here in new **VISKON**... low-cost, versatility, strength, durability and high efficiency. Amazing new **VISKON** is made from bonded textile fibers, either cotton or rayon or a combination of both. **VISKON** is insoluble in common organic solvents, it has an exceptionally high porosity and is resistant to deterioration. Yet, with all these spectacular advantages, **VISKON** probably *costs less* and gives greater clarity than the ordinary filters you are now using!

Whatever *your* individual needs—filtering anything from Air to Zynol—there's just the right **VISKON** fabric to do a better job. Why not investigate low-cost **VISKON** for *your* operation? Write today for complete information... use handy coupon below.

THE VISKING CORPORATION, Dept. PA, Box 76, North Little Rock, Arkansas
Please rush me additional information about new **VISKON** filter fabrics.

Name .....
Position .....
Company .....
Address .....
City ..... Zone ..... State .....
Name of equipment used .....

instantaneous *all-electronic control*

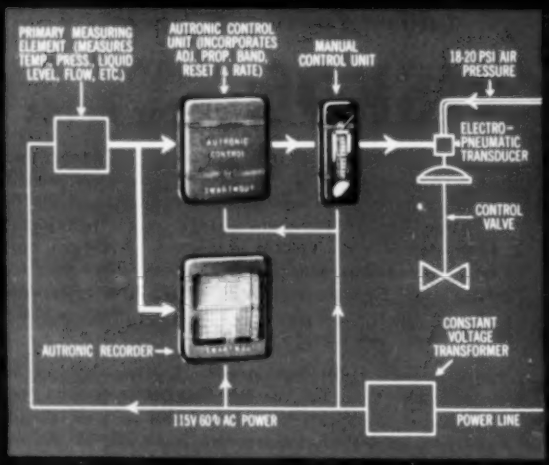


of pressure

temperature

flow

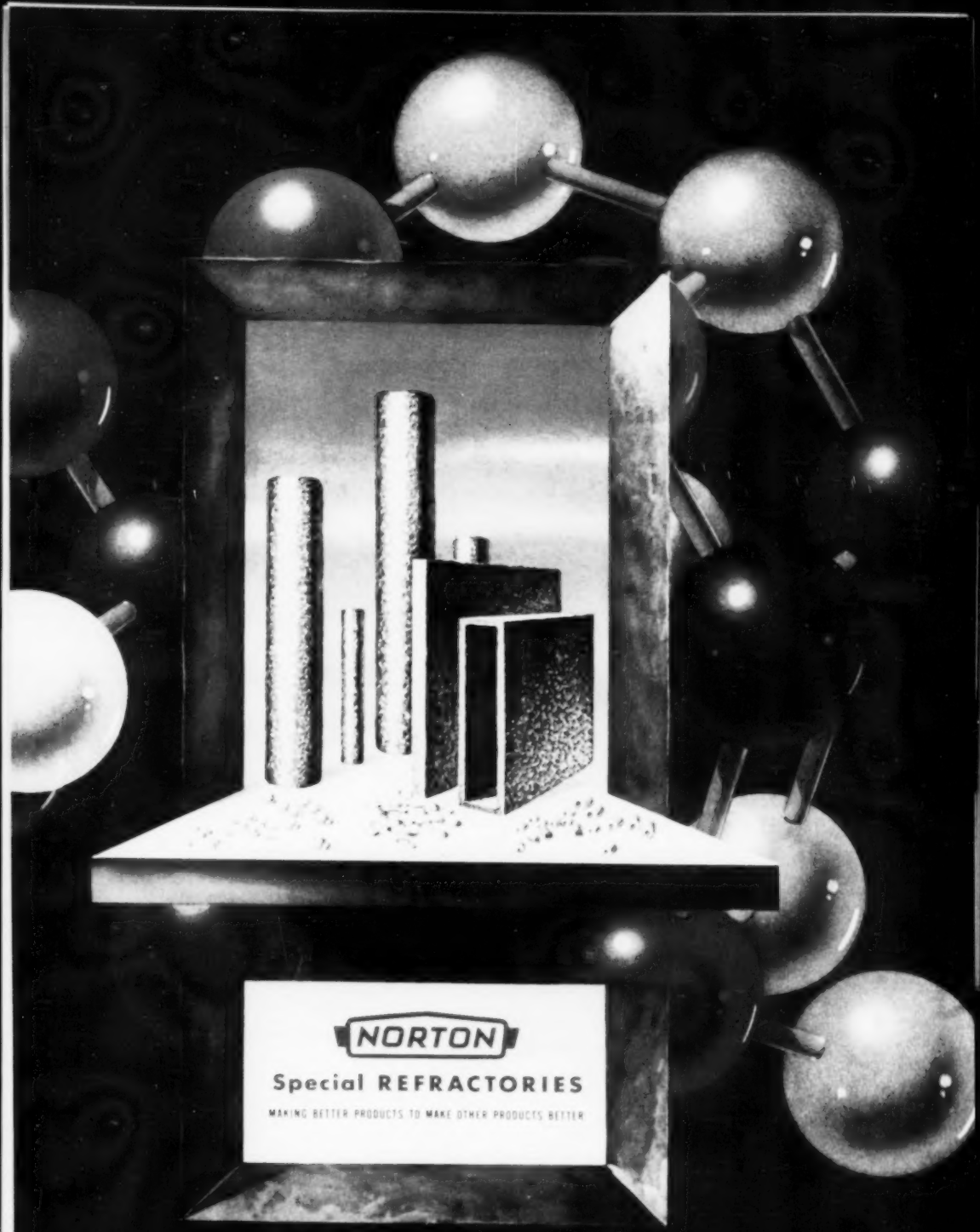
and level . . .


PRIMARY MEASURING ELEMENT (MEASURES TEMP., PRESS., LIQUID LEVEL, FLOW, ETC.)
AUTRONIC CONTROL UNIT (INCORPORATES ADJ. PROP. BAND, RESET & RATE)
MANUAL CONTROL UNIT
18-20 PSI AIR PRESSURE
ELECTRO-PNEUMATIC TRANSDUCER
CONTROL VALVE
AUTRONIC RECORDER
CONSTANT VOLTAGE TRANSFORMER
115V 60 ~ AC POWER
POWER LINE

The new Swartwout Autronic Control System brings new speed, new accuracy to your process controls. Without mechanical motion of any kind this new *all-electronic control system* spans distance between primary element and control element *without interval.* Measuring . . . analyzing . . . correcting —the Autronic System keeps your process on stream . . . assures quality product by controlling pressure, temperature, flow and level properly, instantaneously *without cycling, drifting, shifting.* Call in our engineering representative to explain how Swartwout Autronic Controls will bring new accuracy to *your* process and power instrumentation and control. Or write *today* for literature on the new Swartwout Autronic Control System.

Swartwout *Autronic* **CONTROL SYSTEM**

THE SWARTWOUT COMPANY • 18511 EUCLID AVENUE • CLEVELAND 12, OHIO



. . . For the Chemical Industry

NORTON SPHERICAL CATALYST SUPPORTS give you the benefit of uniform beds, and a choice of "structure-controlled" surfaces and sizes from ¼" to 1". Other supports are rings and pellets. Available in ALUNDUM, CRYSTOLON, MAGNORITE, FUSED STABILIZED ZIRCONIA and MULLITE refractories.

You Improve Processes, Increase Yields or Cut Costs

When Norton SPECIAL Refractories are ENGINEERED for You

In your business, you keep going ahead only when you keep looking ahead. So, research into new ways of turning out more and better products at lower unit costs is always important to you.

Your job of looking ahead will be much easier and more rewarding with Norton Refractory Research working for you. For 40 years, we have helped many chemical processing firms solve high-temperature problems complicated by chemical, electrical, and physical variables. We could tell you how we helped them. But, most of our work has been on a confidential basis. No doubt, you'd prefer us to work that way with you.

WHAT ARE YOUR PROBLEMS?

Are you looking for better catalyst supports? Are you interested in refractories that will let you increase your processing temperatures? Are you having trouble with porous mediums for filtration, diffusion or aeration? Are you bothered by short-lived refractories in your electric furnaces? Do you want to lengthen the life of your laboratory ware?

If you answered "yes" to any of those questions, Norton Refractory Research can be a big help to you. Let's see why.

NORTON CATALYST SUPPORTS HAVE CONTROLLED STRUCTURE

To what degree do you want your catalyst to adhere to the surface of your supports?

Thanks to Norton Company's patented method of controlling porosity, you can specify exactly what you need.

Take Norton spherical supports, for example. Suppose you want maximum catalyst adherence to surface. You specify our medium-porosity spheres. Their porosity ranges from 30% to 35%, with open pores on the outside surface only. On the other hand, let's say you want uniform impregnation of the entire support. Then, you specify our high-porosity spheres to get greater deposition of your catalyst. Their porosity ranges from 42% to 47%, with open pores throughout the spheres. Low-porosity spheres also available if desired.

Both types of Norton spheres are available in diameters from ¼" to 1". They provide you with such a uniform bed that channeling and pressure drop are reduced to a minimum.

Other Norton catalyst supports include pellets and rings in diameters from ¼" to 2".

Materials used in Norton catalyst supports are ALUNDUM®, CRYSTOLON®, MAGNORITE®, FUSED STABILIZED ZIRCONIA, and MULLITE refractories. Each material has its own special properties as a catalyst support. All have the chemical stability and purity that eliminate contamination of both catalyst and end products. High refractoriness and resistance to abrasion contribute to extra long service life.

Norton ALUNDUM Catalyst Supports, in particular, are currently in great demand. They are being used with great success in the manufacture of phthalic anhydride and ammonia and in reforming natural gas. Containing 77% to 89% alumina, they are outstanding for their chemical stability and resistance to abrasion.

Norton ALUNDUM Heat Exchange Pebbles are another product of Norton Research. Because of their high alumina content, 95 to 99%, they stand up under alternating oxidizing and reducing atmospheres at high temperatures. Their high resistance to abrasion makes them ideal for heat exchange beds of either static or moving type.

NORTON STABILIZED ZIRCONIA STANDS 4700° F TEMPERATURE

Here's real evidence that Norton Refractory Research can help you look ahead to the higher temperatures that mean greater yields and increased efficiency.

Norton Company was the first to bring fused stabilized zirconia out of the experimental stage early in 1951 . . . and offer it in commercial quantities. Since that time, it has proved itself in many processes.

No other refractory is so chemically stable at such high temperatures under both oxidizing and reducing conditions. In gas synthesis processes, for example, furnaces lined with Norton FUSED STABILIZED ZIRCONIA have stood up for long periods at temperatures approaching 4700° F in a neutral to slightly reducing atmosphere.

Other properties that have won interest in Norton FUSED STABILIZED ZIRCONIA are its low thermal conductivity – 6.2 BTU in dense shapes at 2000° F, and its high electrical conductivity at elevated temperatures.

Bulletin No. 1409 gives you the whole story on the properties and applications of Norton FUSED STABILIZED ZIRCONIA.

Other Norton Refractories for furnaces include ALUNDUM, CRYSTOLON and MAGNORITE mixtures in brick, plates, tubes, and blocks. Each is engineered to fit your exact requirements.

Strange to relate, Norton Refractory Research has proved to a number of firms, attracted by the amazing properties of STABILIZED ZIRCONIA, that another engineered Norton special refractory was better for them.

It will pay you, too, to call on Norton Refractory Research to work with you.

NORTON ALUNDUM POROUS MEDIUMS MAKE UNIFORM FLOW CERTAIN

Here, again, Norton Company's patented "controlled structure" process comes to your assistance.

REMEMBER, ALL THE NORTON SPECIAL REFRACTORIES DESCRIBED HERE CAN BE ENGINEERED TO FIT YOUR EXACT REQUIREMENTS—

In porous mediums for filtration, diffusion or aeration, you want to be sure of uniform flow. And you're always sure when you use Norton porous plates, tubes, discs or diaphragms. That's because their pores are uniformly distributed, in the size and open-pore ratio you need.

Norton seamless porous tubes, for example, are now being widely used for filtering water, solvents, cutting oils, wine, food oils and other liquids . . . for reclaiming cleaning fluids . . . in boiler feed water treatment . . . and for handling industrial oil wastes. Their seamless construction makes porosity uniform . . . maintains constant air or liquid pressure . . . lets backwashing do a more thorough cleaning job.

Of equal importance to you is the material used in Norton porous mediums. It's Norton ALUNDUM aluminum oxide . . . a tough abrasive and a chemically stable refractory at the same time.

Because of these properties, Norton ALUNDUM porous mediums survive conditions that shorten the life of other products. They are relatively unaffected by the acid or alkaline conditions normally encountered in commercial applications. Their great strength and extreme resistance to abrasion give them extra long life. Their resistance to properly applied temperatures up to 1850° F permits you to burn off organic matter if it clogs the pores.

Custom-made in the sizes and shapes you need. Norton ALUNDUM porous plates, tubes, discs or diaphragms will give you the uniform flow you want at the lowest possible annual cost. *Bulletin No. 750* tells you more.

NORTON ELECTRIC FURNACE SHAPES GIVE TOP PERFORMANCE LONGER

If electric furnaces are as important to you as they are to us, you'll get more help than you can imagine out of Norton Refractory Research.

They're so important in so many vital phases of our own business that we're always looking for new ways of improving their performance.

We have had great success with Norton ALUNDUM cores, muffles, and tubes. There are four reasons why:

1. Norton ALUNDUM furnace parts are made of fused aluminum oxide that is 99+% Al_2O_3.

2. Such purity results in a high degree of stability and chemical inertness. This prevents reactions with resistor materials as well as crucibles and boats of platinum, nickel or fused oxide.

3. Norton ALUNDUM furnace shapes are excellent thermal conductors. This means small temperature gradient between the resistor and furnace interior.

4. Norton ALUNDUM refractory is a good electrical insulator up to relatively high temperatures. One test on an ALUNDUM tube shows a direct current resistance of 7.5×10^6 ohms cm^3 at 600° C. This value did not fall off materially until a temperature in excess of 1600° C was reached.

Where high thermal conductivity and resistance to heat shock are more important, Norton CRYSTOLON shapes offer advantages over ALUNDUM shapes. They are limited, however, to resistors of nickel chromium alloys and to temperatures not exceeding 2100° F.

Norton FUSED STABILIZED ZIRCONIA shows great possibilities as induction heating elements in ultra high frequency induction furnaces and as resistors in high temperature resistance furnaces.

Bulletin No. 458, titled "The Construction of Electric Furnaces for the Laboratory" is yours for the asking.

NORTON ALUNDUM LABORATORY WARE OFFERS YOU MANY ADVANTAGES

No other laboratory ware combines so many of the properties you want for your laboratory development, experimental or analytical work.

1. It's chemically stable. Made of fused alumina containing 85+% Al_2O_3 99+% in special mixtures+, it is not attacked by any organic solvent. Only hydrofluoric acid, concentrated phosphoric acid and strong, hot caustic solutions affect it.

2. It stands temperatures up to 1900° C. So, you can melt pure metals in thick-walled Norton ALUNDUM crucibles. You can also ignite extracted residues in Norton ALUNDUM thimbles.

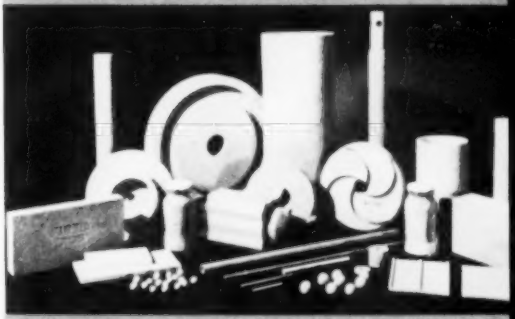
3. It's easy to clean. You just dip it briefly in a fairly strong acid solution (not phosphoric, hydrofluoric or concentrated sulphuric+), wash with water, and ignite to constant weight.

4. For filtering, it comes in four degrees of permeability to retain 0.1, 5.0, 20.0 and 30 microns particle sizes.

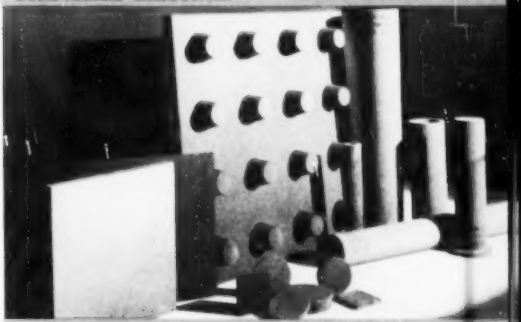
Bulletin No. 793 tells you all about Norton ALUNDUM Laboratory Ware. Get it from your regular source of laboratory ware, or write us direct.

LET'S TALK IT OVER.

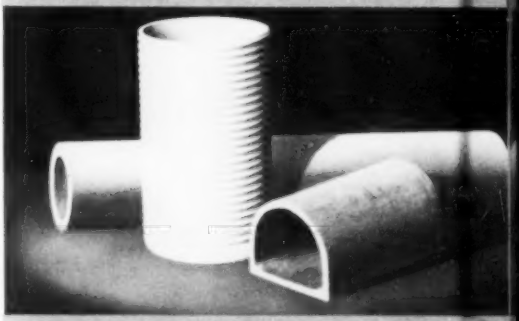
+Trade Marks Reg. U. S. Pat. Off. and Foreign Countries



NORTON REFRACTORY SHAPES FOR REACTION FURNACES come in bricks, plates, tubes and blocks in ALUNDUM, CRYSTOLON, MAGNORITE and FUSED STABILIZED ZIRCONIA.

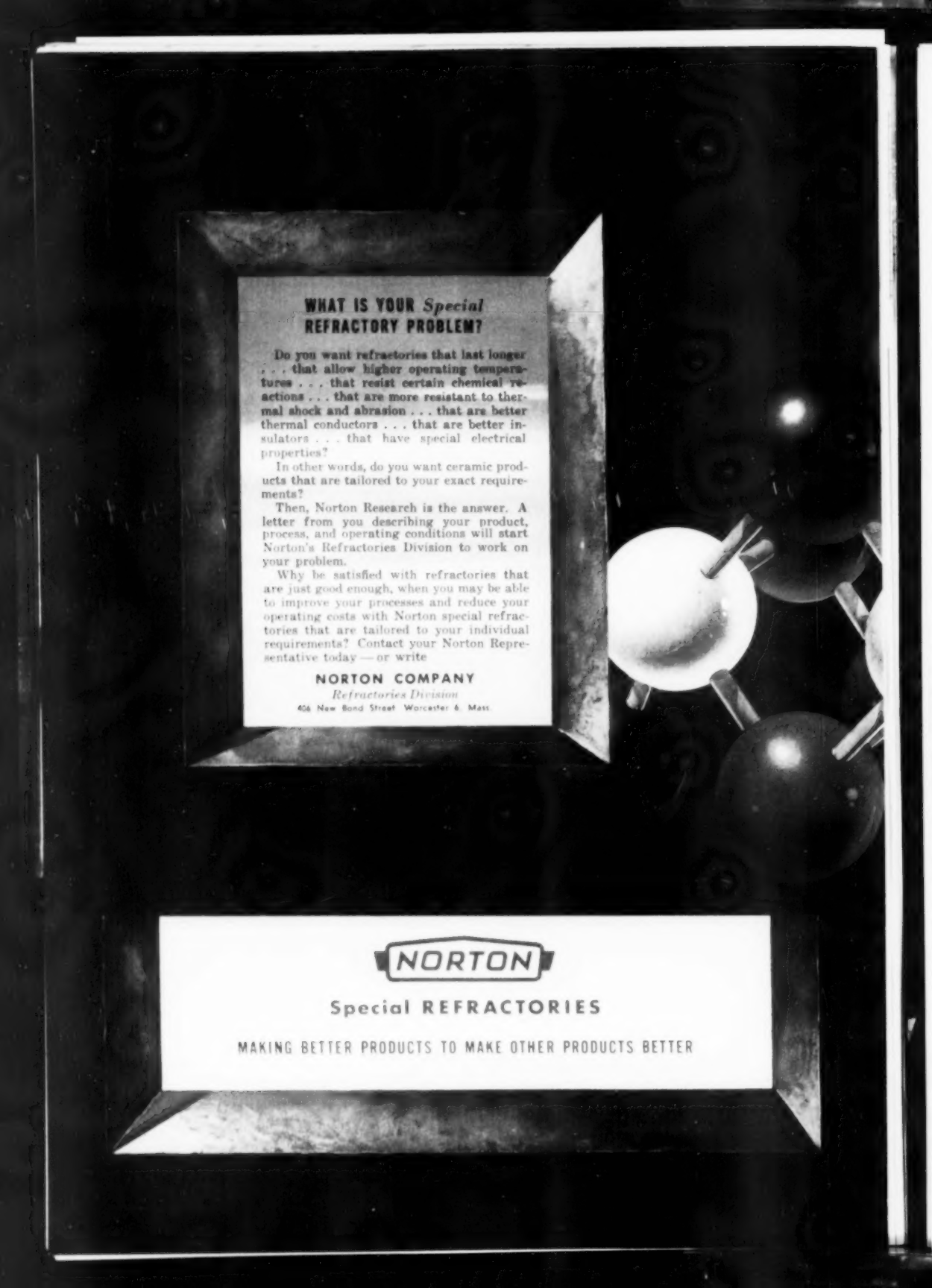


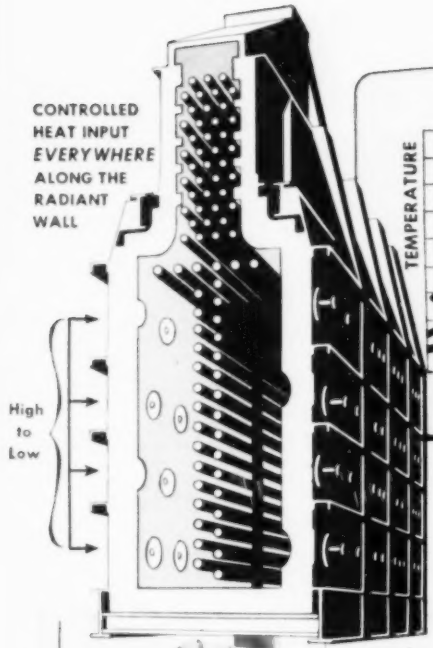
NORTON ALUNDUM POROUS MEDIUMS come in plates, tubes, discs and diaphragms engineered to fit your exact filtering, diffusing or aerating requirements.

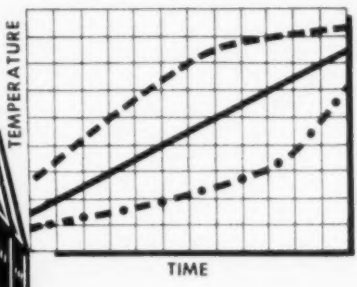


NORTON ELECTRIC FURNACE REFRACTORIES come in cores, tubes, and muffles made of ALUNDUM and CRYSTOLON refractories.

NORTON ALUNDUM LABORATORY WARE, famous for its chemical stability, high refractoriness and uniform porosity, comes in crucibles, ignition capsules, incinerating dishes, cones, dishes, discs, thimbles and boats in all sizes and shapes.


WHAT IS YOUR *Special*
REFRACTORY PROBLEM?
Do you want refractories that last longer . . . that allow higher operating temperatures . . . that resist certain chemical reactions . . . that are more resistant to thermal shock and abrasion . . . that are better thermal conductors . . . that are better insulators . . . that have special electrical properties?
In other words, do you want ceramic products that are tailored to your exact requirements?
Then, Norton Research is the answer. A letter from you describing your product, process, and operating conditions will start Norton's Refractories Division to work on your problem.
Why be satisfied with refractories that are just good enough, when you may be able to improve your processes and reduce your operating costs with Norton special refractories that are tailored to your individual requirements? Contact your Norton Representative today — or write
NORTON COMPANY
Refractories Division
406 New Bond Street Worcester 6, Mass.
NORTON
Special REFRACTORIES
MAKING BETTER PRODUCTS TO MAKE OTHER PRODUCTS BETTER





Set Your Curve... and Match it!

with SELAS *Gradiation*®

HEATERS

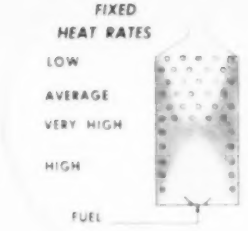
Now, petroleum engineers determine the ideal time-temperature curve for specific refining processes . . . and match it in production with Selas Gradiation Heaters.

Selas Gradiation with precisely controlled, uniform radiant heat input makes possible:

- *Flexibility* in curve shaping
- *Precision controlled* residence time
- *Positive rate-control* of oil heating
- *Complete combustion* with little or no excess air

One refinery manager says: "This radiant heat source provides a high efficiency furnace that is easily installed . . . has low maintenance and fuel costs . . . gives smooth operation with high wind velocities . . . is capable of successfully processing a wide variety of charge stocks. This selective heat input to the radiant coils produces higher heat transfer rates than the conventional heaters . . . saves initial tube costs, reduces residence time, allows high vapor velocities and low pressure drop."

Selas Gradiation Heaters offer new horizons in refining . . . whether small or large refinery, catalytic or thermal cracking. Let us send you more information. Write for new sixteen page booklet.



(Above) Selas Gradiation Heater installed at Phillips Petroleum Refinery.

(Left) Convection type heater, with wide variation in heating rates, small radiant surface in a large tube surface requirement, probably tube overheating, large pressure drops.

SELAS CORPORATION OF AMERICA
PHILADELPHIA 34, PENNSYLVANIA

Heat Processing Engineers for Industry · Development · Design · Manufacture

Hooker Chemical Guide
(ONE OF A SERIES)
USE this handy reference to save time in selecting high quality chemicals.

HOOKER METALLIC CHLORIDES

ALUMINUM CHLORIDE

Formula: $AlCl_3$
Appearance: Gray crystalline solid, supplied in four standard sizes.

TYPICAL PROPERTIES

Molecular Weight	133.3
Aluminum Chloride	98.5% Min.
Sublimables in air at 950° C.	
Iron	0.05% Max.
Heat of Solution	550 small cal/gm

USES

Catalyst: For Friedel-Crafts synthesis, isomerization, alkylation, polymerization, halogenation.
End Products: Plastics, resins, high octane gasoline, lubricants, lube additives, synthetic rubber, dyes, photographic chemicals, pharmaceuticals, etc.
Fluxing agent: For aluminum refining and aluminum casting.

ANTIMONY TRICHLORIDE

Synonym: Antimonous chloride
Formula: $SbCl_3$
Appearance: Yellowish solid

TYPICAL PROPERTIES

Molecular Weight	228.1
Antimony Trichloride	99%
Iron and Arsenic	1% Max.
Lead	0%
Melting Point	73.4° C.

USES

Catalyst (petroleum): With $AlCl_3$ to convert normal butane to isobutane.
Catalyst: Dyes and pharmaceuticals.
Antimony Salts: Mordant in cotton printing.
Metal treating: Antimony plating, bronzing iron, etc.

ARSENIC TRICHLORIDE

Synonym: Arsenous chloride
Formula: $AsCl_3$
Appearance: Clear, colorless to pale yellow liquid

TYPICAL PROPERTIES

Molecular Weight	181.3
Freezing Point	−18° C.
Boiling Point	130.5° C.
Specific Gravity, 14°/4° C.	2.163

USES

Insecticides: In the manufacture of synthetic organic.
Poison Gases: Chemicals containing arsenics for these uses.

For detailed information on items listed, drop us a note on your letterhead. Address your request to HOOKER ELECTROCHEMICAL COMPANY, 4715 Buffalo Avenue, Niagara Falls, N. Y.

HOOKER ELECTROCHEMICAL COMPANY

NIAGARA FALLS, N. Y. • TACOMA, WASH. • WILMINGTON, CALIF.

HOOKER CHEMICALS ®

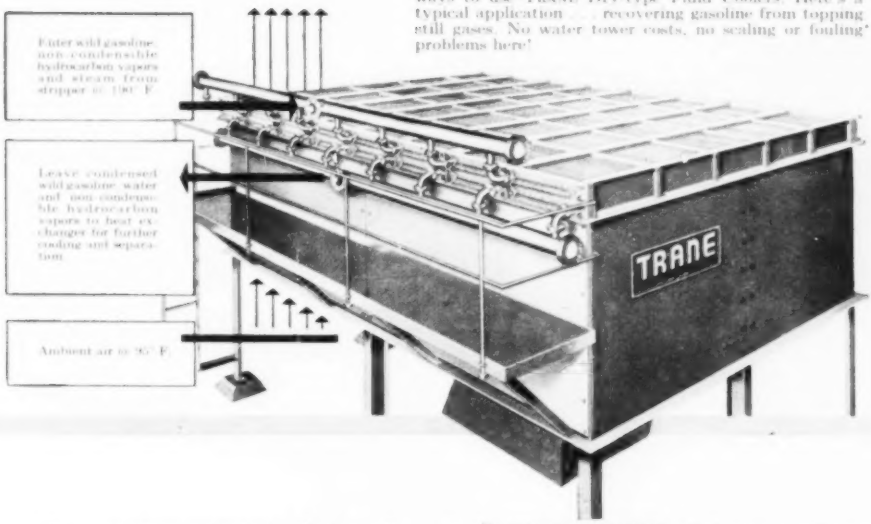
2-134

From the Salt of the Earth

Here's how petroleum processors can cool with air... cut water costs

WITH TRANE DRY-TYPE FLUID COOLERS

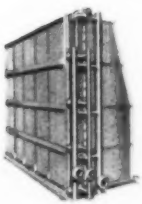
In petroleum processing there are hundreds of profitable ways to use TRANE Dry-type Fluid Coolers. Here's a typical application . . . recovering gasoline from topping still gases. No water tower costs, no scaling or fouling problems here!


Enter wild gasoline, non-condensible hydrocarbon vapors and steam from stripper at 180° F.
Leave condensed wild gasoline, water and non-condensible hydrocarbon vapors to heat exchanger for further cooling and separation.
Ambient air at 95° F.
TRANE

In areas where water is in short supply, and where conditions of heavy fouling and scaling are prevalent, petroleum engineers are discovering that TRANE Dry-type Fluid Coolers solve many of their problems.

There are many sizes of TRANE Dry-type Fluid Coolers. Each is engineered to the job. *Consider these advantages . . .*

1. **NO WATER PROBLEMS:** closed system prevents fouling of water or other fluid.
2. **HUNDREDS OF APPLICATIONS:** applications are limited only by temperature ranges of air cooling and consistencies of fluids to be cooled.
3. **LOW-COST MAINTENANCE:** easier cleaning through removable headers. Fewer shutdowns.
4. **EASY WINTER MAINTENANCE,** compared to cooling towers, because TRANE Fluid Coolers use only air.
5. **HIGH TEMPERATURE CAPACITIES,** limited only by workability of high temperature alloys.



Wide Range of Sizes TRANE Fluid Coolers are available in two models. The larger or vertical discharge model—Series GC—is made in 6 regular sizes with fan diameters ranging from 72" to 144". The smaller or horizontal discharge model—Series EC—comes in 14 sizes with fan diameters ranging from 18" to 120".

Left—TRANE Series EC Fluid Cooler. Main Illustration Above—TRANE Series GC Fluid Cooler.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

MANUFACTURING ENGINEERS OF HEATING, VENTILATING, AIR CONDITIONING AND HEAT TRANSFER EQUIPMENT

(To obtain more data on advertised products see page 1032)

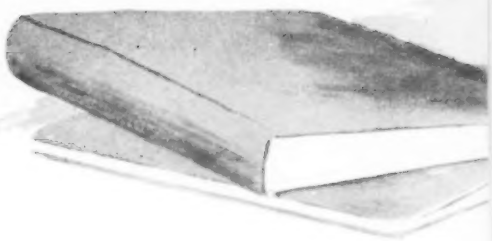
it's a matter of record...

Continuous Hydrogenation

REGENERATION of

PLATFORMING

catalyst solves a lot of problems



"Look what it means to us here at the refinery . . . no costly and otherwise useless regeneration equipment . . . no more worry about the vexing problems of oxidation-type regeneration."

Look at the catalyst itself — specifically designed for the job it is intended to do — highly active — long lasting. And because it operates under mild conditions — free from intense heat — a smaller quantity of catalyst is needed. *It's a matter of record.*

The economy of this flexible, simple operation is all the more important when applied to the sales value of the superior product it produces. Platforming, in all its ramifications, is the one . . . the only *proved* solution to the refiner's reforming problem . . . *it's a matter of record!*

UNIVERSAL OIL PRODUCTS COMPANY

UOP

General Offices: 310 S. MICHIGAN AVE., CHICAGO 4, ILL., U.S.A.

Laboratories: RIVERSIDE, ILLINOIS

Universal Service Protects Your Investment

...WHO

made it possible for refiners to use tetraethyl lead antiknock compound?

...DU PONT!

In 1923, Du Pont put into operation the first safe, commercial process for making tetraethyl lead. And, until September 1945, Du Pont was the *only* manufacturer of TEL in the United States.

What's more, since 1923, Du Pont has produced approximately 60% of all the tetraethyl lead used in gasoline in this country to date.

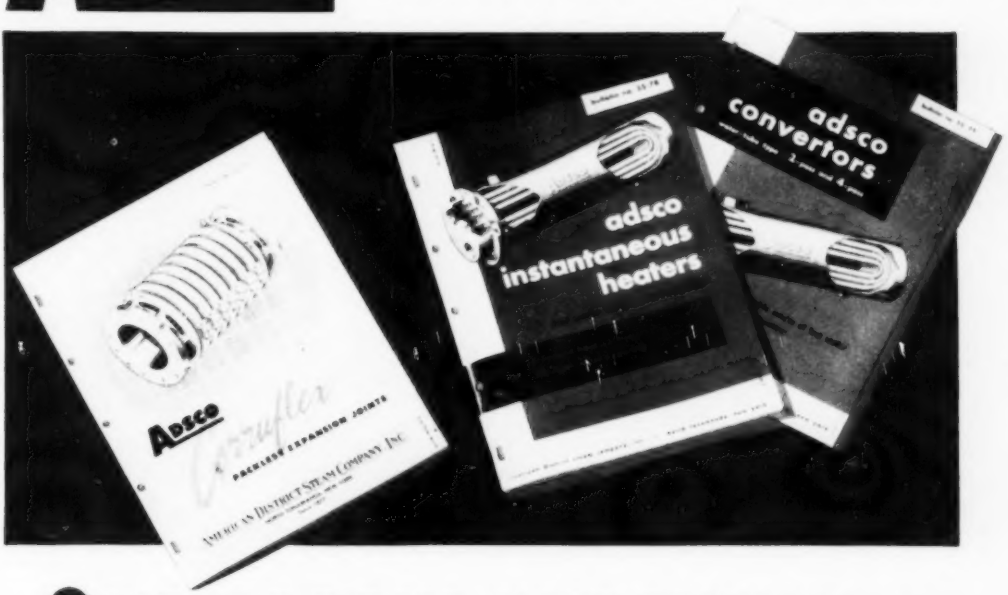
Today, Du Pont is expanding its TEL manufacturing facilities with the addition of a new plant. And its technical, research and marketing services have more than kept pace with its production expansion. A Du Pont representative will be glad to explain how the many Du Pont services can be helpful to you.

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & CO., (INC.) • Petroleum Chemicals Division, Wilmington 98, Delaware

ADSCO TECHNICAL BULLETINS



3 NEW BOOKS JUST PUBLISHED SEND FOR YOUR COPIES *TODAY!*

● Adsco's three new bulletins—one on Corruflex Packless Expansion Joints, one on Instantaneous Heaters, and one on Convertors—are the most authoritative in the industry. These new bulletins will provide ready information you will always need. *Here they are:*

1. CORRUFLEX ... 28 pages with complete information on selection, specifications, and installation; 9 pages of tables on weights and dimensions. Drawings of 8 typical piping arrangements; 29 drawings of basic joints and their variations.

2. INSTANTANEOUS HEATERS ... 56 pages, with 49 pages of tables. Capacities and pressure drops for 198 heaters at 9 steam pressures and 12 temperature ranges. Special information and tables on coolers and on booster, swimming pool and other types of heaters.

3. CONVERTORS ... 32 pages, with 24 pages of tables. Capacities and pressure drops for 148 convertors at 7 steam pressures and 15 temperature ranges. Detailed instructions on how to select a convertor. Special charts and information on problems related to convertors.

ADSCO
75 YEARS OF LEADERSHIP

MAIL THIS COUPON TODAY!

AMERICAN DISTRICT STEAM COMPANY, INC. Dept. PP-7
North Tonawanda, N. Y.

Please send me the bulletins checked:

- ☐ Corruflex Packless Expansion Joints
- ☐ Instantaneous Heaters
- ☐ Convertors

Name _____

Company _____

Address _____

City _____ *State* _____

(To obtain more data on advertised products see page 1032)

3 ways B-L can help you with a castable lining for catalytic equipment

Engineering

Today, the same high-caliber engineering that pioneered the use of suspended linings for refinery furnaces is available to you for castable linings, too. This new B-L innovation is designed to give you a serviceable, yet economical enclosure for catalytic equipment—vessels, lines, cyclones, stacks and ducts.

Materials

Two proven A.P. Green Fire Brick Company materials—SK-7 and KS-L—combine to provide an enclosure adaptable to abrasion, corrosion or heat problems. Various thicknesses of these factory-mixed insulating cements are "gunned" over meshes to form a smooth monolithic wall.

Erection Help

It all adds up to a single coordinated source for the three elements of a vessel lining or heat enclosure job. In addition to high-level engineering and jobs-tested materials, B-L is prepared to offer erection service. It all adds up to *one complete package, one contract and one responsibility.*

WRITE FOR YOUR COPY OF THIS NEW BOOK:

"One Source", a new B-L catalog, is yours upon request. No obligation, of course.

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

BIGELOW LIPTAK Corporation

2550 W. GRAND BLVD. • DETROIT 8, MICH.

IN CANADA

BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK
PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.

NEW FACILITIES

for Fluor's Mid-Continent Division

A complete organization for the design, engineering and construction of plants and facilities for the petroleum, chemical and allied industries

To better serve the tremendous industrial growth of the Mid-Continent and Gulf Coast areas, Fluor's Mid-Continent Engineering Division has recently moved into new and permanent headquarters in Houston, Texas. These new and completely modern facilities are designed specifically for the efficient and expeditious handling of a large variety of engineering and construction services for the petroleum, natural gas, chemical and allied industries.

In addition to these on-the-spot services offered by the Mid-Continent Engineering Division, other important advantages and considerations include: strategically located storage and maintenance facilities for construction tools and equipment at Paola, Kansas; recourse to the broad engineering and research talents of the *entire* Fluor organization; and, the financial security and buying power of a major company—one with national recognition and over a half century of experience.

MODERN FACILITIES

Fluor's modern building pictured above was completed in mid-1952. A second building is to be completed in late 1952. Both buildings are air-conditioned and are designed on a compartmental basis to provide engineering offices, drafting rooms, blueprint rooms, supply and storage areas, and offices for accounting, purchasing and administrative personnel. Each building contains 15,000 square feet of floor space—a total of 30,000 square feet devoted exclusively to the work of Fluor's Mid-Continent Engineering Division.

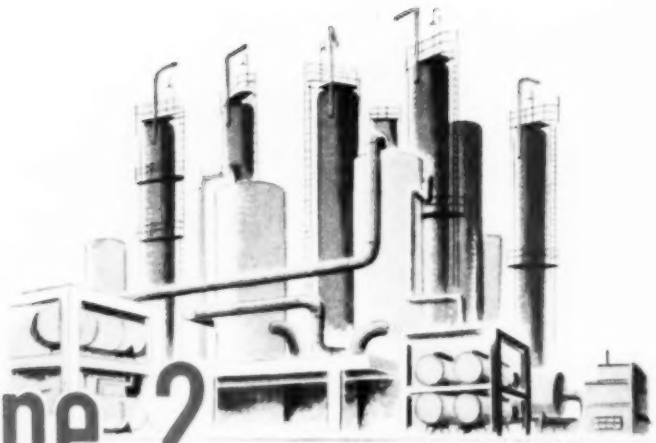
FLUOR

Engineers - Constructors - Manufacturers

THE FLUOR CORPORATION, LTD. • LOS ANGELES • HOUSTON
New York, Chicago, Pittsburgh, Boston, Tulsa, San Francisco, Birmingham and Calgary

Represented in the Sterling area by
Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.1, England

(To obtain more data on advertised products see page 1032)



Tenamene 2

inhibitor-sweetening

Cuts costs — eliminates danger of contamination — saves time and equipment

Tenamene 2 inhibitor-sweetening involves the use of this efficient Eastman gasoline additive both as a sweetening agent and as a gum inhibitor, and thereby makes possible the combining of two operations in a single step.

Tenamene 2 appears to act as an oxidation catalyst with regard to mercaptans. Its presence in sour gasoline enables refiners to convert mercaptans to disulfides merely by adding 10-20° Baume caustic and bubbling air through such gasoline at slightly elevated temperatures.

The Tenamene 2 itself is not reacted upon and thus remains in the gasoline after the sweetening process to provide effective protection against the formation of gums.

WHEN TO USE: If you are depending upon a solutizer process and have trouble in economically obtaining "Doctor" sweet gasoline, we recommend that Tenamene 2 inhibitor-sweetening be investigated as an adjunct to your present process. When Tenamene 2 inhibitor-sweetening and solutizer sweetening are combined, a considerable reduction in heat costs and a saving in time and equipment can frequently be realized, due to the decrease in recycling necessary in the solutizer units. The small amount of disulfides remaining in the gasoline after this combination treatment does not seriously affect tetraethyl lead susceptibility.

Where oxidation processes such as Copper sweetening or Doctor sweetening are used, we recommend that Tenamene 2 inhibitor-sweetening be considered as a replacement. While this process is also one of oxidation, it not only eliminates the dangers of copper or free sulfur contamination, but also eliminates the costly regeneration of the treating agents.

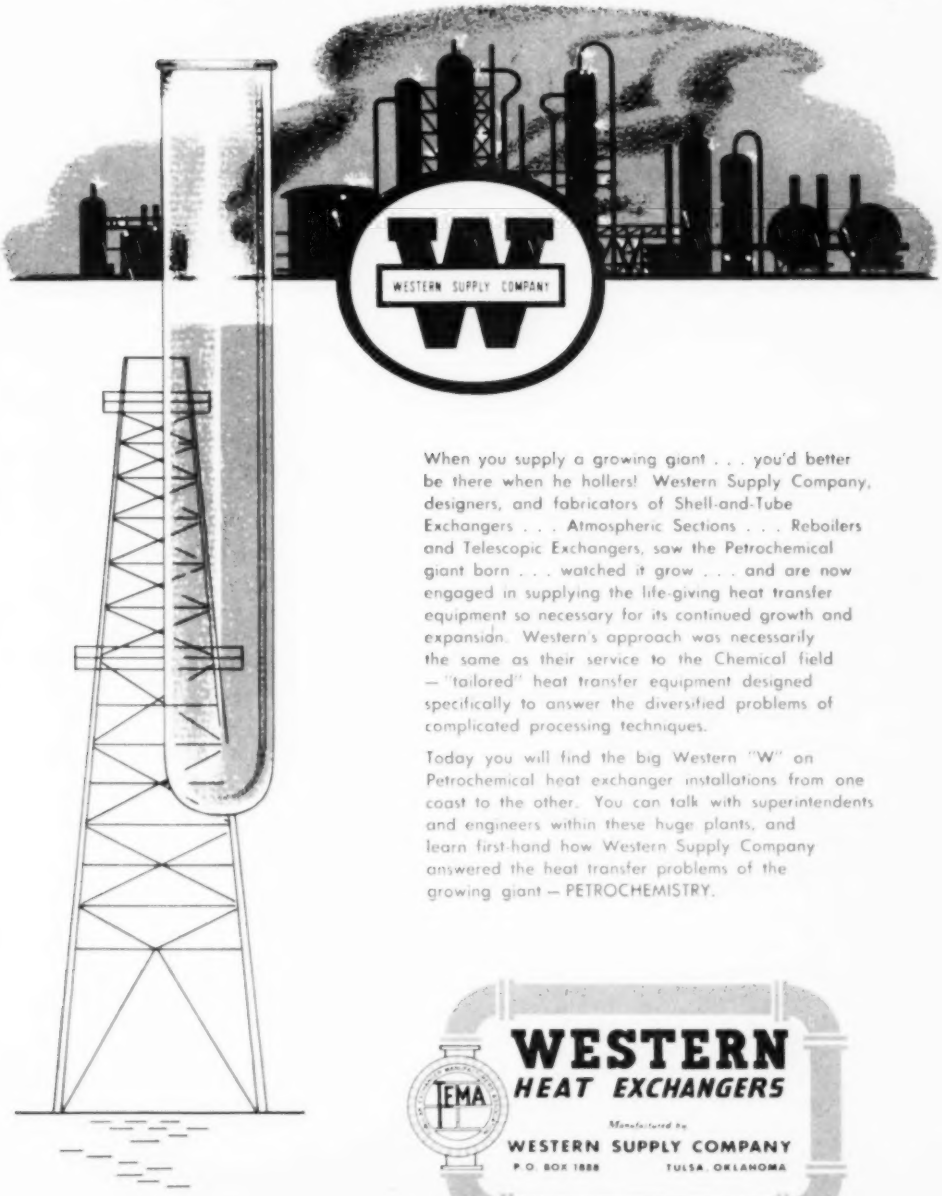
HOW TO SWEETEN WITH TENAMENE 2: Sour gasoline is first freed of hydrogen sulfide, organic acids and the more reactive mercaptans by a conventional caustic wash. 4 to 26 pounds of Tenamene 2 per 1,000 bbls. of gasoline are then added along with approximately 10 volume percent of 10° to 20° Baume caustic and air or oxygen. The resulting mix is thoroughly agitated and piped to a settler. The effluent from the settler is handled in the same manner as the effluent from conventional sweetening units, except that no more inhibitor is required.

Whatever your present sweetening process, it will pay to investigate Tenamene 2 inhibitor-sweetening. The staff of our gasoline laboratories will be pleased to work with you in determining how this process can be most effectively used in your refinery. Contact your local representative or write to Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tennessee.

Tenamene EASTMAN GASOLINE ADDITIVES

SALES REPRESENTATIVES: New York—260 Madison Ave.; Framingham, Mass.—7 Hollis St.; Cleveland—Terminal Tower Bldg.; Chicago—360 N. Michigan Ave.; St. Louis—Continental Bldg.; Houston—412 Main St. **West Coast: Wilson Meyer Co.,** San Francisco—333 Montgomery St.; Los Angeles—4800 District Blvd., Portland—520 S. W. Sixth Ave., Seattle—821 Second Ave.

HEAT TRANSFER for the *Petrochemical Industry*



When you supply a growing giant . . . you'd better be there when he hollers! Western Supply Company, designers, and fabricators of Shell-and-Tube Exchangers . . . Atmospheric Sections . . . Reboilers and Telescopic Exchangers, saw the Petrochemical giant born . . . watched it grow . . . and are now engaged in supplying the life-giving heat transfer equipment so necessary for its continued growth and expansion. Western's approach was necessarily the same as their service to the Chemical field — "tailored" heat transfer equipment designed specifically to answer the diversified problems of complicated processing techniques.

Today you will find the big Western "W" on Petrochemical heat exchanger installations from one coast to the other. You can talk with superintendents and engineers within these huge plants, and learn first-hand how Western Supply Company answered the heat transfer problems of the growing giant — PETROCHEMISTRY.

TEMA

WESTERN
HEAT EXCHANGERS

Manufactured by
WESTERN SUPPLY COMPANY
P.O. BOX 1888 TULSA, OKLAHOMA

(To obtain more data on advertised products see page 1032)

First Aid for Cat Crackers Anywhere

If your cat cracker develops ills or you have a technical problem on catalysts, a Filtrol engineer is ready to serve you on short notice. In a recent 30-day period our engineers gave technical field assistance and performed laboratory evaluations for refiners over a widespread area that included Edmonton, Alberta; Montreal, Quebec; Tulsa, Houston, Philadelphia and Los Angeles.

Years of experience in producing cracking catalysts and observance of varied cracking operations form a background for Filtrol's technical service and assistance in this field. Write for particulars.

Other reasons for using Filtrol catalysts:

1. Higher octane barrels
2. High butylene yield
3. Low cost
4. Sulphur resistant catalysts
5. Faster regeneration rate
6. Varied plant facilities
7. Uniformity
8. Lowered excess butane
9. Low attrition rate

Filtrol Corporation

Offices: 727 West Seventh St., Los Angeles 17, California
Plants: Vernon, Calif.; Salt Lake City, Utah; Jackson, Miss.

Filtrol® CATALYSTS AND ADSORBENTS

PENBERTHY *Jet Pumps*

(EJECTORS • EDUCTORS • EXHAUSTERS • SYPHONS)

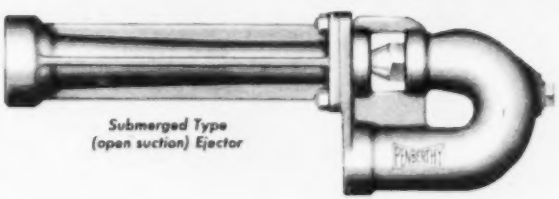
Often the MOST ECONOMICAL and EFFICIENT WAY to Transfer and Mix Fluids

The jet pump is a simple device which uses steam, water or air under pressure to pump (or mix) fluids that can include solids in suspension. Jet pumps have no moving parts, need no lubrication, have no packing glands, are practically noiseless. They are low in initial cost and installation cost . . . compact in size and trouble-free. Penberthy offers a variety of jet pumps for a wide range of ordinary and unusual applications. They can be made from materials that withstand corrosion, contamination and high temperatures. Ask for new Bulletin 512.

Standard Ejector for Steam or Air Operation

Standard Hydraulic Ejector

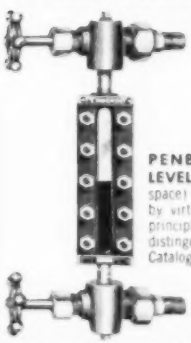
Stainless Steel Jet Pump for Handling Corrosive Chemicals



Submerged Type (open suction) Ejector

WRITE FOR *New* BULLETIN No. 512

OTHER PENBERTHY PRODUCTS



PENBERTHY TRANSPARENT LIQUID LEVEL GAGE—Used to observe color and density of liquids under high pressures and or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY REFLEX LIQUID LEVEL GAGE—Empty space (or steam space) shows white and liquid shows black by virtue of a simple, unvariable optical principle. Accurate reading as far as you can distinguish black and white. Write for Catalog 35.

PENBERTHY AUTOMATIC INJECTOR—Will supply feed water to boiler at minimum cost. Quickly, easily installed, reliable under most severe operating conditions. Ask for Bulletin 513.

4731

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

Detroit 2, Michigan

•

Established 1886

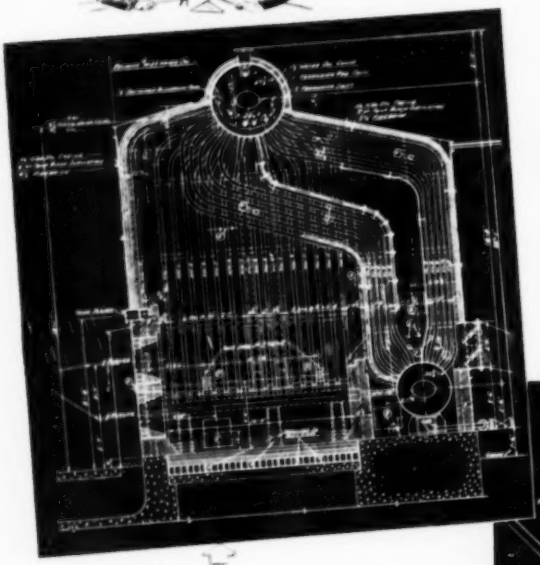
•

Canadian Plant—Windsor, Ontario

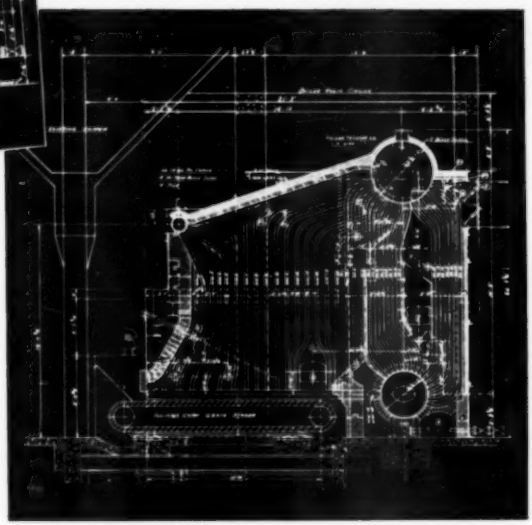
(To obtain more data on advertised products see page 1032)

Industry Approved

Two-Drum
STEAM GENERATORS
by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky., is served by this 50,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS

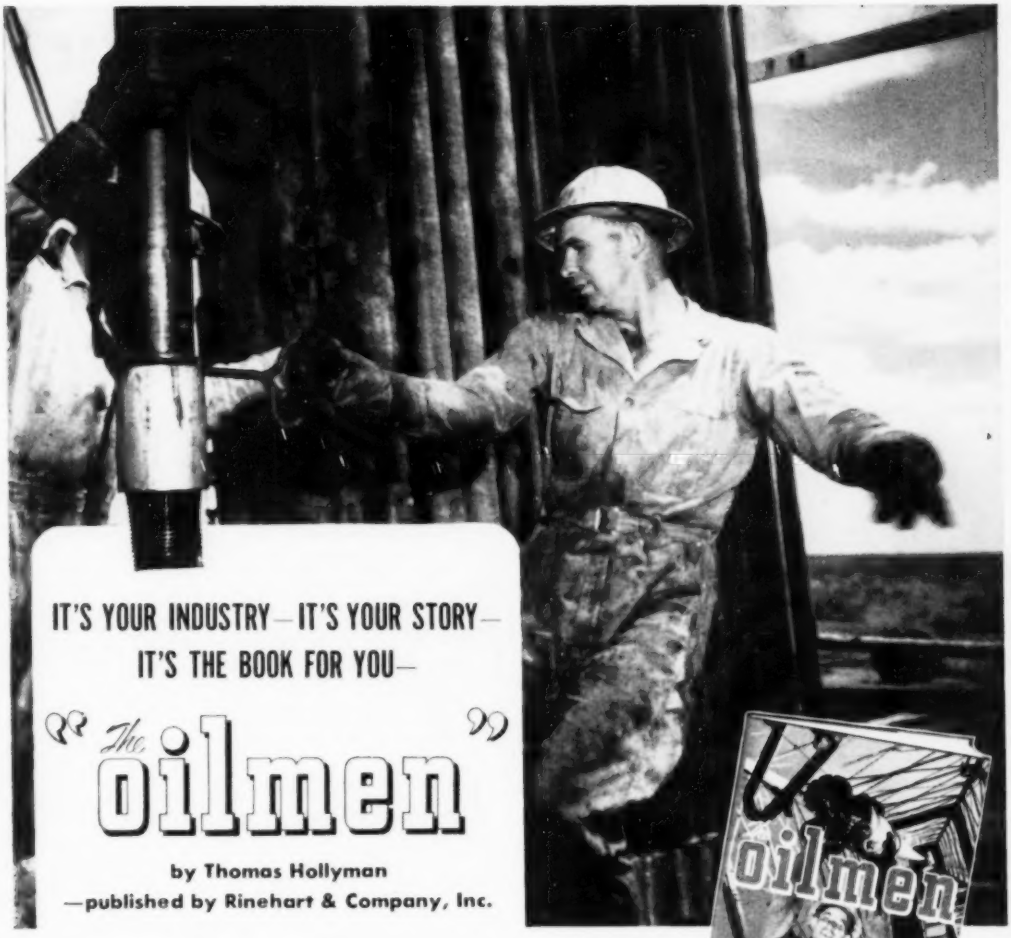
DISTILLERIES • HOTELS

HOSPITALS • CHEMICAL PLANTS

PETROLEUM REFINERIES

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.



IT'S YOUR INDUSTRY—IT'S YOUR STORY—
IT'S THE BOOK FOR YOU—

"The oilmen"

by Thomas Hollyman
—published by Rinehart & Company, Inc.

$1.50 ACTUAL SIZE 10½" × 10¼"

It's a book you'll use hundreds of times ...the picture story that captures the personality of an industry

● Consulting photographic editor of *Holiday*, and a contributor to other leading magazines, Tom Hollyman now turns his lens on *oil*—to tell its exciting story in terms of the industry's men and women.

Dramatically photographed, concisely written, cloth-bound and oversize, "The Oilmen" tells petroleum's full story from search to discovery . . . through production, refining, transportation, marketing . . . to the ultimate user's door. It's a book the industry has needed for years, a book that every man and woman associated with petroleum must see, read, own.

"The Oilmen," published by Rinehart & Company, Inc.

at all leading book stores—or send coupon

Shell Oil Company and its employees co-operated with Mr. Hollyman to make this picture story possible—and offer this announcement as a service to the men and women who have made oil the nation's No. 1 source of energy.

Rinehart & Company, Inc., Dept. 2
232 Madison Avenue, New York 16, New York

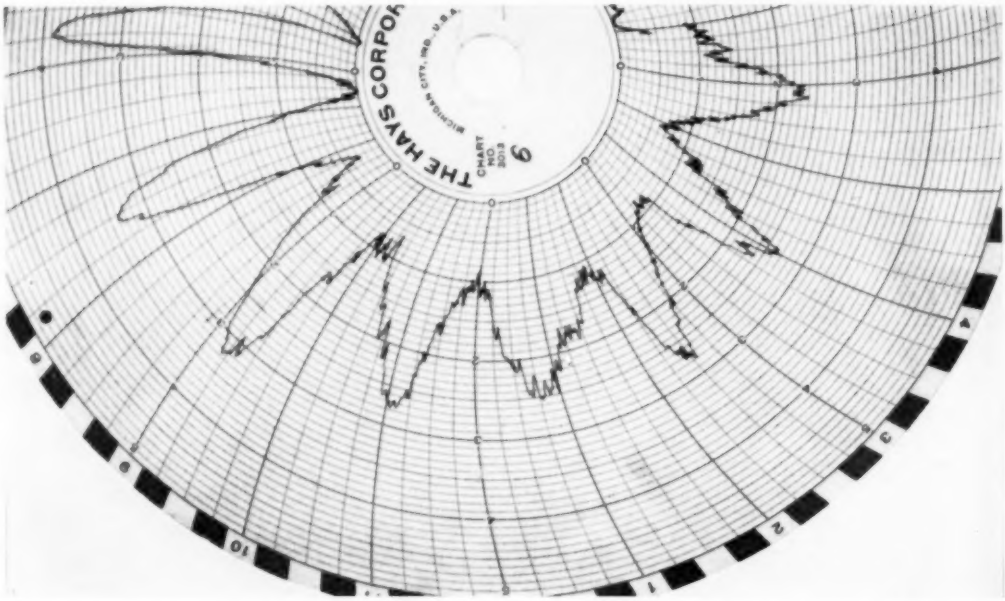
Please send me ____ copies of THE OILMEN @ $1.50.
I enclose check or money order in the amount of $____.

Name _____

Address _____

_____

Portrait of a "team" at work



Swings show efforts of new crew. Before catalyst regenerator was brought to point of operation through use of Hays Magno-Therm O_2 Recorder. Note that swings are smaller at right of chart indicating that stability is being approached.

The chart illustrated above was produced during the starting-up period of a new catalyst regenerator. The wide "swings" on the chart graphically illustrate the efforts of the "team"—a new crew and their Hays Magno-Therm Oxygen Recorder—to operate the unit efficiently. Their problem: To achieve continuous, stable operation thus avoiding "after burning" (excess O_2) which would damage the catalyst and the regenerator as well as too little burning (deficient O_2) which would not effectively regenerate the catalyst.

Solution

Answer to this problem was the "team" operation by crew and Hays Magno-Therm Oxygen Recorder. The "team" now maintains the O_2 content of the effluent gases between 5% and 2.0% thereby producing effective catalyst without damaging the multi-million dollar installation.

The operating crew could do this because the Magno-Therm O_2 Recorder reflects, without lag and in a direct and magnified manner, changes in the amount of excess air present, thus making control a simpler task. No longer need the crew attempt to operate with only indirect, small temperature changes as a guide.

For process heaters and boiler plants

The Hays Magno-Therm Oxygen Recorder has also been successfully and *profitably* applied to process heaters and refinery boiler rooms where multiple fuel firing is a problem.

With the Hays Magno-Therm Oxygen Recorder you get:

• Freedom from effect of varying Hydro-Carbon ratios of different fuels • Continuous, highly accurate indication and recording • Complete compensation for temperature and pressure effects • Freedom from chemicals or hazardous fuel burning in the analyzing process • Swift, sure electronic operation

Hays Bulletin 51-829 tells the complete story of the Magno-Therm. Write for it.

THE HAYS CORPORATION
MICHIGAN CITY 23, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Ventrol • Gas Analysers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

July ★ One of a Series of Interest to the Petroleum Industry ★ 1952

Du Pont Celebrates 150th Anniversary

Six thousand Du Pont employees with 10 years of service or more will attend the company's 150th Anniversary ceremonies on July 18th at the site of the original powder mills along the historic Brandywine at Wilmington, Delaware.

Dramatic episodes in the company's history will be enacted on this occasion augmented by the Du Pont chorus. Speakers will point out the broad philosophy of the company and the effect this philosophy had on its growth. Mr. Crawford Greenewalt, President, will speak on the future of the Du Pont Company, not in a material way, but rather in consideration of the problems of a large corporation in the coming years.

Wide Range of Movies Available to Oil Companies Through Du Pont Film Library

To help you relate your sales promotion activities as closely as possible to the individual interests of your various customer groups, Du Pont makes available to the oil companies a comprehensive assortment of films.

They cover a wide variety of subjects . . . gasoline quality, safety, automotive maintenance, farming and lubrication. There are many general interest films, too . . . on oil industry operations and economics, on research, on the free enterprise system, and even one on how color conditioning can improve working conditions and employee relations in offices and plants.

Not all of the films were produced by the Du Pont Company. Many of them were originally made by the U. S. Bureau of Mines, by oil companies and by automotive parts makers. But for your convenience, they are available through the Du Pont Film Library.

MANY USES

Several of the films are suitable for dealer training and employee education, as well as for sales promotion. And the new Du Pont movie, "Pipeline on Wheels," is specially tailored to the oil industry's public relations needs.

How can you obtain the films? Just write the nearest Du Pont Petroleum Chemicals Division district office for a brochure describing the films in detail and giving complete instructions on how to request the films you want.

"PIPELINE ON WHEELS" Movie Wins A Top Safety Award

Oil Executives Aided in Production of Film . . . Helped Make it an Outstanding Success

The Petroleum Chemicals Division of the Du Pont Company was recently advised by the National Committee on Films for Safety that it had won one of the committee's annual awards for the motion picture, "Pipeline on Wheels."

BEHIND THE SCENES—"Pipeline on Wheels" was produced on location by professional Hollywood directors, actors, cameramen and sound and light specialists.

What's Your Standing Among Competitive Octane Ratings?

You'll find the answer to this important question in the July issue of Du Pont's Quarterly Motor Gasoline Survey.

The results of this survey are scheduled to roll off the presses in the middle of July so that copies will be in refiners' hands during the week of July 21st.

This edition should be of particular interest to refiners and marketers — especially since the TEL shortage has been alleviated and government restrictions lifted.

The film was selected as a co-winner of top honors in the non-theatrical general classification for movies produced during 1951. It was chosen on the basis of its contribution to safety as well as for technical excellence.

OIL MEN CONTRIBUTE

Although "Pipeline on Wheels" was produced by Du Pont for the oil industry, many oil men contributed to its success. In preparing the script, Du Pont consulted over a hundred representatives of the API and NPA, executives of individual oil companies, automotive engineers and safety officials. Their enthusiastic cooperation brought forth many suggestions and ideas which were incorporated in the film. As a result, the film is accurate and authoritative.

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED

Movie Award

PUBLIC RELATIONS VALUE

The main objective of this full-color sound movie is to help oil companies overcome some of the prejudice against operating tank trucks on public highways. Produced in Hollywood, the film is specially designed to show the public how tank trucks are built to incorporate every possible safety feature — and how the oil companies train their drivers for safe highway operation. It also emphasizes the fact that gasoline tank trucks are vitally important to our modern motorized civilization.

By presenting a case for the tank truck, it is a valuable public relations tool for the oil industry. As such, it is suitable for oil company showings to municipal authorities, safety groups, civic organizations, state highway officials and legislative groups.

All demonstrations shown in the picture are authentic and filmed under the actual conditions described in the script. One of the dramatic highlights of the movie, for example, occurs when an ultra-hot gas jet fire is built under a tank truck trailer loaded with gasoline. This demonstration provides convincing proof that the modern tank truck can be subjected to a severe fire without exploding.

The film delivers its message in the form of an entertaining human interest story. And besides filling a definite need in public education, the film is an ideal aid for training tank truck drivers and maintenance crews.

AN OIL INDUSTRY EXCLUSIVE

Shortly after "Pipeline on Wheels" was released for showings, the demand for its use exceeded all expectations. Originally, since the movie was produced for the exclusive use of the oil industry, 50 prints were made up. But, as requests for the film came into the Du Pont district offices, it soon became apparent that this quantity was not enough. Today, there are 175 prints in circulation among oil companies throughout the country.

What's more, requests for prints poured in from insurance companies, fire departments, trucking firms and many other interested groups. But, because of Du Pont's policy to distribute the film exclusively through oil companies, all of these requests from non-oil organizations were channeled to the oil companies to enable them to take full advantage of the public relations value of the film.

NEW HEAD OF EXPORT SECTION

WALTER MEES

Holland born Walter Mees heads up the petroleum chemicals sales section of Du Pont's Organic Chemicals Department. Mr. Mees' appointment to this position some months ago was part of a substantial expansion of the Company's export organization handling such petroleum chemicals as tetraethyl lead, gasoline dyes and antioxidants, Metal Deactivator, grease stabilizers, lube oil additives and cetane.

After graduating from a commercial and technical college in Holland, Mr. Mees entered business in Canada and abroad. In 1929 he joined the Royal Dutch Shell Group and passed through all phases of the oil industry from drilling to marketing.

In 1935 he entered another field, but returned to Shell in 1945 and until 1949 served as General Management Assistant with the Shell Caribbean Petroleum Company in Venezuela. Mr. Mees joined Du Pont in May 1950 and since that time has worked exclusively with petroleum chemicals products.

New Du Pont TEL Storage and Tank Truck Terminal Being Completed on Pacific Coast

Within a few months, Du Pont's new tetraethyl lead storage terminal at El Monte, California will be functioning full blast on behalf of the oil industry in Southern California.

The terminal, complete with railroad sidings for receipt of tank car shipments, and with weigh tank and storage facilities, will make all deliveries via Du Pont owned tank trucks.

One purpose of this is to make TEL more conveniently available to those refiners who previously had to receive "lead" in drums due to lack of railroad sidings.

The terminal will also help insure an immediate emergency supply of tetraethyl lead to refiners whose regular shipments may have been held up by local floods, or other delays *en route*. And large refiners who for any reason whatsoever may be in need of rush shipments smaller than tt. R. tank car lots can also benefit by the new tank truck delivery system.

Further, to expedite the handling and delivery of TEL, Du Pont-designed Metal-Flex hose installations are used in both the loading and unloading operations at the terminal.

LITERATURE AVAILABLE

Here is a partial listing of the bulletins, reports, booklets and aids available to you through your Du Pont Petroleum Chemicals Division district office:

Safety for the Small Refinery — A 42-page book on how to set up an effective small refinery safety program. Serial A-2848

Tank Talk — A 52-page, easy-to-understand safety booklet for tank-cleaning crews. Serial A-1134

Stability of Present-Day Gasolines — A 12-page paper on the value of storage tests—as compared with induction period—for determining stability of modern gasolines. Serial A-3199

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited — Toronto, Ontario — Montreal, Quebec — Calgary, Alberta

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

Printed in U. S. A.

"...On the feet of Individuals."

Society advances on the feet of individuals. We Americans live under the highest standard ever achieved because we believe in and are permitted currently to practice three of the cardinal principles of progress—Invention, Research and COMPETITION.

Nineteen basic inventions influence our pattern of life today. Each one was created to satisfy a fundamental need for improvement—a modern means of competing as against outmoded procedure. Each one, such as the electric light, the telegraph, the amplifying tube, the induction motor, created a new industry in which numerous companies strove in free competition for the maximum share of business.

For example, since Thomas Edison invented the incandescent filament lamp in 1880, the electric light industry has grown to an annual volume of $501,500,000 in light bulbs alone; in May, 1906 the Wright Brothers received the patent for their flying machine; the value of aviation manufactures in 1951 in the United States alone was estimated at $4,350,000,000 and in February, 1952, records show a $10½ billion backlog of orders.

More rapid still is the growth of the radio-television industry which today produces some $230 million worth of home radio sets and $1,570,800,000 in television sets. In every case, employment and sales volume grew enormously and the public enjoyed huge personal benefits.

Side by side with Invention came Research, exemplified by the competition of intelligent men questing for new materials, new methods, new processes, new scientific truths. Current advertisements tell of hundred-year tests to assure better materials for the future, technology that produces metals to withstand almost inconceivable heat, machines calculating 20,000 times faster than the mind of man, medicines that cure "incurable" diseases, food processes that cook, sterilize and pack hundreds of cans a minute. And in every case, the public enjoys huge personal benefits.

This is what James A. Decker undoubtedly had in mind when he wrote the line, "Society advances on the feet of individuals." These "individuals" are you and I, all our countrymen, benefiting every day from Invention, Research—and from COMPETITION.

Developing inventions, marketing products, and pursuing scientific research require substantial investments. A grave danger to their future now looms. In 1951, corporation net profits suffered a loss of 21% over the previous year. The reason—taxes too high, government controls and policies that interfere too greatly with private industry. If this continues, financial resources will dwindle, competition will be stifled.

Without free competition, American progress stops. No country can long exist when its government calls all the shots. We need competition to assure progress for people.

★ ★ ★

This report on PROGRESS-FOR-PEOPLE is published by this magazine in cooperation with National Business Publications, Inc., as a public service. This material, including illustrations, may be used, with or without credit, in plant city advertisements, employee publications, house organs, speeches, or in any other manner.

THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

What does it cost to stop?

In many continuous processes so much depends on the unfailing operation of centrifugal compressors that the cost of a breakdown could be greater than the original cost of the compressor. That's why *dependability* in a compressor is your first concern.

Here are some things you should know before you buy any centrifugal compressor.

Who makes it? If it's a Carrier, it's made by people who've been making centrifugal compressors for thirty years now, people who've made some 2500 multi-stage centrifugals—more than anyone else.

How do they make it? If it's a Carrier, it's made by experienced craftsmen in the world's largest single plant devoted to the production of centrifugal compressors.

What's their application background? If it's a Carrier, it's made by the people who've handled more different gases than any other compressor manufacturer . . . the people who pioneered the use of centrifugals in many industrial processes.

In short, if it's a Carrier, it'll deliver the dependability you must have in a centrifugal compressor.

Our new catalog, "Centrifugal Compressors for Industry," will help you. Ask for it at the Carrier office nearest you, or write Carrier Corporation, Syracuse, New York.

Many of the men who built the first Carrier Centrifugal Compressor thirty years ago still build them.

This leak test is one of many tough tests and inspections each Carrier Centrifugal Compressor must pass.

IS Specialized Engineering Needed?

Readers reply to article in May issue on training of petroleum refinery engineers

A NUMBER of letters have been received by the editors of PETROLEUM PROCESSING commenting on the article "Is Specialized Engineering Needed?" by Eugene F. Gibbons, published in the May issue (pp. 615-619).

In general, we were taken to task by those in the education profession, who believe it is a step in the wrong direction to break up engineering curricula into more fractions. Comments from industry representatives were fewer and complimentary of the article.

In view of the great degree of interest evidenced in this highly controversial subject, some of the more pertinent comments received are presented below.

Emphasis Should Be on Application Of Fundamentals in a Refinery

Prof. Kenneth A. Kobe, Dept. of Chemical Engineering, University of Texas—"I would like to point out that Mr. Gibbons has taken one of the two alternative conclusions that can be drawn from my reply to his Question Five, 'How can private industry help promote this specialized training? Is the establishment of scholarships, making research grants and the like the answer to the problem?' The fact that the petroleum companies establish fellowships and scholarships does not necessarily mean that they are interested only in promoting specialized training. It more probably means that they are interested in stimulating the interest that the chemical engineering student has in the petroleum refining industry.

"In my discussion with personnel representatives who visit the University of Texas, I find that they, as well as other executives in the industry, continually stress the need for teaching fundamentals. Fundamentals are taught in the undergraduate chemical engineering curriculum. Specialization that is inherent in the petroleum refining curriculum takes the student away from fundamentals and the broad training that it gives. Here at the University of Texas our specialized course in the applications of these fundamentals in the petroleum refining industry is centered on a course given in the first year of graduate work. This does not imply that other graduate courses are not equally applicable, such as advanced courses in flow of heat, distillation, absorption, and diffusional operations. It certainly should be unnecessary to give specialized courses in dewaxing, lube oil stock brightening, and work of that character. These are vocational types of courses that should be avoided.

"May I point out in your Table 2 that the five-year curriculum at Texas A. and M. leading to a degree in chemical engineering-petroleum engineering is one in which petroleum engineering is petroleum *production* engineering and offers no more material of interest to the refinery engineer?

(*The curriculum listed in Table 2 of the article is described in the Undergraduate Catalog of Texas A and M as "intended to provide a background so that the graduate may have the necessary fundamentals to engage in the refining, natural gasoline, development, production, transportation phase of the petroleum industry, or in allied industries which employ similar techniques or materials."*—*Ed.*)

"May I also point out that in the recent graduate school which I helped set up for Conselho Nacional do Petroleo in Brazil the one year of training represents graduate training with emphasis on applications of fundamental unit operations and chemical engineering thermodynamics to refinery problems? These are gathered together in a course in process design which I feel is the heart of this specialized program. This work on process design, although it is applied to a petroleum refinery, would be just as applicable to an alcohol refinery, a petrochemical plant or, in general, any type of chemical plant processing gases and liquids. Fundamentals can be taught and emphasized in their relationship to a petroleum refinery without going overboard in technology courses and vocational courses like dewaxing.

"To summarize, I feel that an undergraduate course in petroleum refining engineering is a snare and a delusion to a student. He will be better off to take a course in chemical engineering. Specialized training without sacrificing fundamentals should be given in graduate work, but the emphasis should be on the application of fundamentals to a petroleum refinery. The viewpoint should never be that of technology or vocational training.

"I am sure that every engineer working in a petroleum refinery will admit that the types of operation carried out now are quite different from those carried out twenty years ago. The modern refinery is a complex petrochemical plant in comparison with the simple operations carried out twenty years ago. Only by having a man trained in fundamentals can he keep abreast or

in advance of the changes that are bound to take place in petroleum refineries in the next twenty years."

(In a subsequent letter, Prof. Kobe expressed the following additional opinions.—Ed.)

"... This discussion of specialized training is one that has been carried on for a long time in engineering circles. I feel that it is unfortunate that PETROLEUM PROCESSING has come out for specialized training in the refining and petrochemical industries. Personnel men in industry settled this question long ago, and technical executives have continued to emphasize the need for training in fundamentals over specialized training. Certainly, this is true at the bachelor's level, and the specialized training that may be given as part of graduate work again should be tied firmly to fundamentals."

Texas A and M Does Not Offer Degrees in Refining

J. D. Lindsay, Head, Dept. of Chemical Engineering, Agricultural and Mechanical College of Texas.—"... the article ... is garbled in respect to our own particular situation and certainly implies the wrong impression.

"We at Texas A and M do not give a degree in 'Petroleum Refinery Engineering Chemical Engineering' as stated in your Table I. Some one has inserted 'Refinery.'

"The information in the last column on pg. 617 is at least misleading. Under 'Five Year Course' the second paragraph starts off 'Even in schools with petroleum refinery engineering curriculum specialized courses are not offered usually until the third year in a four year course.' (Note the use of the term refinery.) A very suitable curriculum is offered by A and M College of Texas, where a five year course in chemical engineering leads to a B. S. degree in both chemical engineering and petroleum engineering.' This sentence is almost correct, i.e. five years of work will lead to the two B. S. degrees mentioned. It is an error when you say, 'a five year course in chemical engineering' because it is as much a five year course in petroleum engineering. That is, in five years a boy will take just about all the required courses in petroleum engineering and chemical engineering. He is registered in both departments. The big error is in the implication of the first sentence which includes 'refinery.' Our petroleum engineering is not refinery engineering. As in many schools the emphasis is on petroleum production. Many of our chemical engineering students go to work in petroleum refineries, and from all I can learn from responsible men in charge of these operations our chemical engineering students are doing all right for themselves and the company. As nearly as I can find out the employers of the four year undergraduate chemical engineers do not want us to teach 'refinery engineering' and I keep in close touch with our students and their employers. Very few, if any, boys from the petroleum engineering course here go into refinery work. ...

"I certainly think it is well to encourage boys to go into engineering but I doubt the wisdom of splitting it up into too many fractions. We are having the pressure put on us to have a curriculum in 'Oil Seed Engineering' and some want it broken down even more into 'Fat Engineering.' There is a practical limit as to how far you can go in four year undergraduate teaching. Corrosion engineering, instrumentation engineering, safety engineering, plastic engineering, human engineering. All of these have been proposed. I think it is well to give some courses, perhaps as electives, in many of these fields but do not think it desirable to grant degrees in them."

(PETROLEUM PROCESSING was in error in including Texas A and M in Table I as offering a degree in petroleum refinery engineering.—Ed.)

Difficulty Is Definition of "Specialized Training"

George Granger Brown, Dean, College of Engineering, University of Michigan.—"The staff writer apparently summarizes the results of the survey as follows: 'Leaders in education and the oil industry alike generally abhor the suggestion that petroleum refinery engineering or other types of specialized training be taught in American colleges and universities on the undergraduate level.' His object in the paper is then apparently stated in the second column, page 615, 'we will attempt to show that there is a definite need for specialized training on the undergraduate level,' although this done apparently 'for the purpose of argument in this article.'

"The handling of the whole matter leaves me somewhat confused in that it clearly shows that men in industry and education generally are against a petroleum refining engineering program at the undergraduate level, but the writer has asserted that it is a practical necessity to offer such a program to undergraduate engineers.

"I am really of the opinion that there is very little disagreement between the results of the survey and the staff writer, once we get the language straightened out so we use the word specialized training to mean exactly the same thing. However, I am not at all sure of this because quite frequently the writer appears to strongly favor a specialized undergraduate program training men for the Petroleum Refining Industry. If that is what is meant by specialized training, I am sure the results of the survey indicate that both industry and education is generally opposed to it. On the other hand, if by specialized training the writer means using the petroleum industry as an example of the basic principles the teacher is trying to get across, rather than using the sulphuric acid industry or some other industry, then of course there is no objection. This would be particularly true if by specialized training the writer means intensive study of the applications of certain principles through engineering practice.

"I think it is a specialization by exclusion in which the student simply is taught the technology and the operations of a given industry to the exclusion of other industries and the broad fundamentals. That is objected to by both men in industry and in the teaching profession. Unfortunately it is this kind of a curriculum which is usually set up whenever one mentions a special curriculum for a given industry."

Integration Is Aim of Tulane Project, Not Specialization

Raymond V. Bailey, Head, Dept. of Chemical Engineering, School of Chemical Engineering, Tulane University of Louisiana.—"The Department of Chemical Engineering at Tulane University sincerely appreciated your complimentary presentation of the activities within our Division of Chemical Engineering Practice in your recent article, 'Is Specialized Engineering Needed?' However, we fear that an erroneous impression may have been conveyed to the readers ...

"As is the practice in other departments of chemical engineering, we provide for three years of instruction in the basic fundamental principles and a fourth year which is devoted primarily to the integration of previously learned facts and principles by means of project work. Our division of Chemical Engineering Practice is not a petroleum refinery engineering option and does not have as its primary purpose the training of specialized engineers in petroleum refining. Instead, our primary objective is the effective integration of previously

learned facts and principles through the use of current engineering practice, and the application of these facts and principles to the solution of industrial problems. This integration practice is in accord with the 'Qualifications for an Accredited Curriculum in Chemical Engineering' prepared by the Chemical Engineering Education Accrediting Committee of the American Institute of Chemical Engineers:

"'The major emphasis in the last years should be placed on the integration of previously learned facts and principles by means of project work. By the term "Project Work" is meant the application of various disciplines to the solution of comprehensive problems which cover a broader field than the usual short problem given in that course or the work of a student on a design problem or laboratory investigation or a cost analysis. The project is characterized by the fact that it cannot be solved by a few formulæ and a limited set of data, but requires the exercise of considerable thought and judgment in planning the attack and bringing together of many facts, principles and techniques in executing the work to arrive at the goal. The exact subject matter of the project and the name of the course in which the student meets this type of experience is relatively unimportant. Typical course names under which such work is given are: plant or process design, comprehensive problems, economic balance, laboratory project, research, thesis, chemical processes and the like.'

"Each student who participates in the Division of Chemical Engineering Practice has received a thorough training in Chemical Engineering. There has been no substitution of specialized courses for basic engineering courses. The projects in the Chemical Engineering Practice have been selected for their broad general applicability in the chemical industry. The graduate has had excellent training for any phase of the chemical industry. However, due to the fact that the Division of Chemical Engineering Practice is operated within a petroleum refinery, the students do acquire, as a by-product of their chemical engineering education, a specialized knowledge of some phases of the petroleum industry. This specialized training which is acquired incidental to the accomplishment of our primary objective of integration is the only type of specialized training which we would approve for undergraduate chemical engineers. However, this does not prevent the specialized training from being of appreciable value to those students who elect to go into the petroleum industry. Further, we feel that departments of chemical engineering should use great care in the selection of the project work for chemical engineering seniors and should so select the projects that the students would acquire specialized knowledge of some chemical process and the current engineering practice in that particular process."

Should Encourage Industry To Promote Such Training

Roy J. Diwoky, Executive Vice President, Pan-Am Southern Corp.—"... I was particularly pleased with the handling of our practice school project at the Destrehan refinery.

"The graph preceding the text on 'Is Specialized Engineering Needed?' effectively illustrates the serious present and future estimates of the shortage of trained chemical engineers, and should attract many intelligent readers to carefully consider the need for stimulating specialized training in order to meet the growing manpower needs of the expanding oil and petrochemical industries. I feel that you have performed an outstanding service in publishing this article .... It should encourage the refining industry to actively participate in promoting specialized training in the complex field of petroleum chemistry.

"I am convinced that the program worked out between our Company and Tulane University is a reasonable and practical attempt to do something about the problem. Although the specialized training has been in effect only since February of this year, my personal observation has been that the students as well as Company and University personnel show great interest in the project. The results over a relatively short period of time have exceeded my original expectations. I am grateful to you for recognizing its potential value and appreciate the publicity you have so capably given it.

Higher Salaries Suggested For Older Engineers

Henri J. Molaison, P. E., New Orleans, La.—"I read with interest your article ... in the May issue.

"I might comment that as a Chemical Engineer I deplored for many years that Chemical Engineers seemed barred from many jobs of a general engineering nature, although conditions in this respect seem to have improved, that is, chemical engineers are now more accepted by their brothers in the other engineering branches.

"Your chart of Fig. 1, I feel, doesn't tell the whole story of the chemical engineer shortage. If industry would open up to engineers over 35, and pay them salaries in line with those offered inexperienced engineering graduates today, one step would have been taken toward the eventual solution of the shortage.

"Locally, the Louisiana Engineering Society has an active Vocational Guidance Committee that has been really working in conducting talks on the engineering profession with local high school student groups. I am a member of that committee and have visited many local high schools myself (as a group member). If we're working on the 'young end' to help industry, industry should be willing to admit older engineers also."

Article Helps Publicize Shortage of Engineers

Elwood G. Glass, Jr., Industrial Relations Asst. to the Technical Manager, Manufacturing Dept., Standard Oil Co. (Ohio)—"... I think your handling of the subject was very well done. As you are undoubtedly well aware, as much publicity as possible needs to be given to the extreme shortage of technically trained college graduates. This article, and others like it, should certainly help publicize this by getting into the homes of men in the petroleum industry, and perhaps influencing the boys of pre-college age to go into engineering as a career."

* * *

Dean Brown of the University of Michigan has probed in the right direction by questioning our use of the word "specialized." Perhaps we should use the word "intensified." At any rate, we advocate a program very much like that of Tulane, which grounds a student firmly in the basic principles of chemical engineering, and then as a part of his undergraduate training devotes at least one semester *in* a particular field.

Also, it appears that we did not emphasize our point as strongly as we believed we had. We contend that specialized (or "intensified") training should be offered primarily to graduate students, and that only *outstanding* undergraduates should have the opportunity to take such courses.

We suggest the step as a means of alleviating the present engineering shortage. We do not believe it to be a cure-all, but are convinced that it would help shorten the transition time from classroom to industry.

E.F.G.

DO'S and DON'TS for

Maintaining Electric Controllers

to prevent costly repairs and downtime on motors

DO . . .

- ✔ Guard against personal contact
- ✔ Kill power before repairing
- ✔ Have enough renewal parts
- ✔ Inspect equipment regularly
- ✔ Keep complete records
- ✔ Keep controllers clean
- ✔ Sandpaper to clean contacts
- ✔ Replace contacts by pairs
- ✔ Keep connections tight
- ✔ Operate coils at rated voltage
- ✔ Replace frayed shunts
- ✔ Keep moving parts freely moving
- ✔ Keep air gap surfaces clean

DON'T . . .

- ✘ Use high pressure air to clean
- ✘ Make units hard to get at
- ✘ Use emery paper to clean contacts
- ✘ Neglect contact springs
- ✘ Use coils with open circuits
- ✘ Replace parts in wrong position
- ✘ Use oil on contact or relay bearings
- ✘ Use substitutes in oil dashpots
- ✘ Permit excessive temperatures
- ✘ Allow undesirable grounds

By L. E. MARKLE
Westinghouse Electric Corp.

MAINTAINING electric motor controllers prevents expensive repairs and costly equipment "downtime." For good maintenance, these considerations are important:

1. The first and most important requisite is safety to personnel. Safety is accomplished by enclosing, guarding, or remotely locating apparatus to avoid personal contact—and by disconnecting all power before touching or repairing any apparatus.

2. The initial installation should be well made. All parts should have ample capacity. Installation work and wiring connections should be well done. Tests should be made to prove the adequacy of the equipment and installation before final acceptance is granted by ultimate user.

3. An adequate supply of correct renewal parts should be available for prompt use when replacements are necessary. Renewal parts should be obtained from the manufacturer of the original equipment, to be sure that the parts are correctly made.

4. A systematic and regular plan of inspection should be arranged to keep all equipment in good operating condition. Such a plan provides preventive maintenance.

Some suggestions for good preventive maintenance are:

1. Personnel should be capable and alert, trained and prepared to make repairs when the need is first observed.

2. Regular inspections of equipment should be made, frequently enough to prevent serious trouble from developing.

3. If extensive repairs are required, inspector should report them immediately—initiating plans for the work as soon as possible.

4. Records indicate which installations are most troublesome, what repairs most frequently needed. They minimize interruption of service when a major maintenance job must be done. And, records show whether or not maintenance costs are excessive.

Any record that keeps the desired maintenance information in good order is satisfactory. It should be a convenient record, easily maintained. Maintenance personnel soon will know what type of record best suits their individual requirements. Since controllers and motors are so closely associated, it is suggested that this record include proper information on both types of equipment.

Controller Enclosures

Most controllers are mounted in some kind of metal enclosure. This may be done to protect personnel from live parts, or it may be desirable because of local conditions. The most common enclosure is a sheet metal one that encloses all live parts. It may be ventilated or non-ventilated.

For locations where dirty atmospheric conditions exist, dust-tight enclosures will reduce the maintenance on controller parts. These enclosures require gaskets and are so made that no dust or dirt can enter them.

Weather-resistant, drip-tight, water-tight, and submersible-type enclosures are necessary where the corresponding service conditions are factors in maintenance requirements.

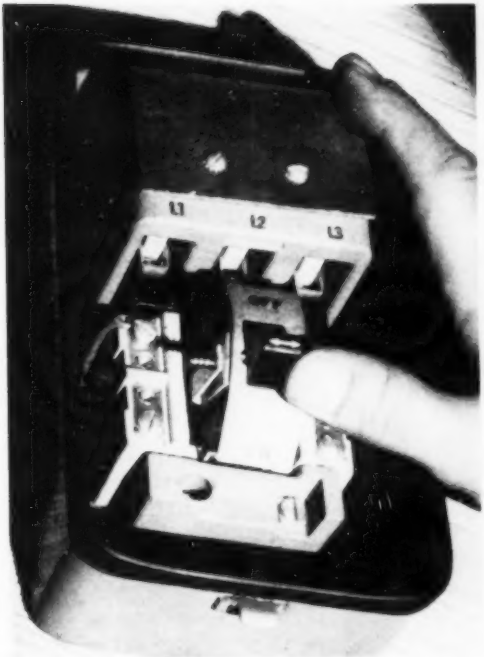
For hazardous locations such as petroleum and petrochemical plants, or wherever explosive atmospheres are present, the enclosures are of heavy construction. They are so designed that they will withstand explosions of the gases within the enclosure without damage to the enclosure and without permitting any flames to emerge from it to cause external fires and explosions. Oil immersed controllers also are used to prevent explosions in dangerous locations.

Where acid fumes or other highly corrosive atmospheres exist, maintenance work will be minimized if the controller parts are immersed in oil and the enclosure is protected by a suitable finish.

Clean Controllers—Less Maintenance

Very few industrial controllers operate in clean places. Dust, dirt, oil and moisture—separately or in combination with each other—all create maintenance work. They reduce insulating distance across otherwise clean and dry surfaces. They collect dust and dirt that may cause sluggish mechanical action of electrical devices.

Accumulations of dust and dirt should be removed regularly either by vacuum or by compressed air. (Excessive air pressures should be avoided because sharp, small particles may be driven into some insulating materials.) Special attention may be required to remove the metallic dust that collects and ad-

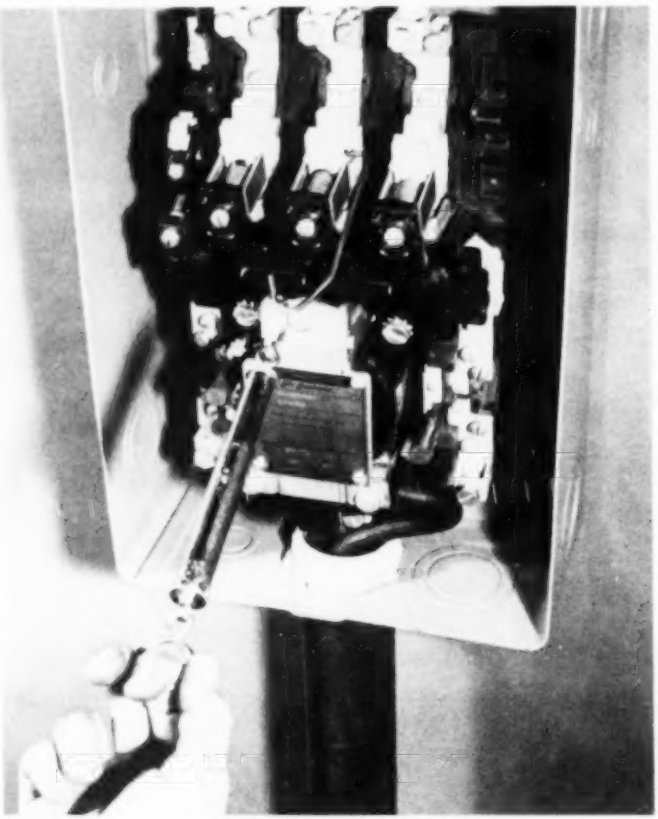


DUSTY, DIRTY LOCATIONS require gasketed metal enclosures for controllers

MECHANICAL WEAR has removed too much contact surface. Throw it away

ELECTRICAL WEAR has burned off too much contact surface. Throw it away

ROUGH, DIRTY CONTACTS should be cleaned with sandpaper



CONTACT PRESSURE CAN BE CHECKED with a tension spring and a wire hook

heres to the magnetized parts of the controller. Dirt, oil, and moisture sometimes are most easily removed by wiping with cloths and suitable solvents.

Moisture due to condensation may collect within an enclosure. Drainage holes are sometimes acceptable to relieve this condition. Heaters often are used to prevent moisture by condensation. The heaters are most essential when the controller is idle. When in operation the coils and resistors within the enclosure will usually provide enough heat to prevent condensation.

Accessibility

For inspection and easy repair work, all parts should be made as accessible as possible. It should be possible to renew contacts, coils, springs, and other important parts quickly and with few tools. Installations should be arranged so that all units are accessible for maintenance work.

Every time contacts open or close they are subject to mechanical wear and electrical burning. Contact parts, therefore, are items that may require considerable maintenance depending upon operating conditions. The mechanical wear of contacts that operate every second may be more serious than the electrical burning.

Contact Materials

Contacts are generally made of copper or silver. Certain other materials can be used for special applications but should be recommended by the manufacturer. These materials usually have higher resistance and less current carrying ability than copper or silver. Large contacts for heavy currents are almost always made of copper. They may use silver sections or inserts at the place where final contact is made to improve current carrying ability or reduce heating. Silver contacts are generally used on the small current carrying contacts of relays, electrical interlocks, pushbuttons, thermostats, pressure switches and similar devices.

Contact Surfaces

Contacts should be kept clean. This is especially true of copper contacts because the discoloration that soon appears on clean copper is not a good electrical conductor. It therefore increases the contact resistance, and is often the cause of serious heating of contacts. When contacts are renewed, it is important to clean the new contact, if it is discolored, and the surface against which it is mounted.

The slight rubbing action and burning that occur during normal good operation generally will keep contact surfaces clean enough for good service. Contacts that seldom open or close, however, readily will accumulate the thin discolored surface that may cause heating.

The dense discoloration that soon appears on clean silver is a relatively good electrical conductor. It is not so necessary, therefore, to keep silver contacts clean except for appearance.

Burned Contacts

When contacts carrying excessive currents are closed or opened, or when contact motion is sluggish, the contact surfaces may be severely burned. If this burning causes deep pits or craters — or a very roughly burned surface — both the stationary and moving contacts should be renewed.

It is not essential or even desirable to have contact surfaces entirely smooth. Slightly roughened surfaces that appear during normal good operation, if clean, provide better contact area than smooth surfaces. Contacts with surfaces comparable to very coarse sandpaper may be considered in good condition.

Contacts that are dirty or excessively rough should be cleaned and smoothed with sandpaper. A fine file may be used, but be sure to maintain the true surface shape or contour of the original contact. The designer often spends much time and effort to determine the best contact shape. Changing the original shape by careless filing will leave high points or edges that may overheat. Emery paper should not be used to clean contacts. It is an electrical conductor. Furthermore, some particles become imbedded in the contact surfaces and cause unnecessary wear.

Worn Contacts and Contact Pressures

As contacts wear, the material in them gradually disappears because of both mechanical wear and electrical burning. During the wearing process the contact pressures decrease. This affects the current car-

rying ability of the contacts and, if allowed to get too low, will cause overheating of the contacts. A small contact with suitable pressure will carry current with less heating than a large contact with little or no pressure. Reasonable provisions are made for the wearing of contacts when the original designs are made, but replacements eventually will be necessary. Manufacturers will furnish information on correct contact pressures for their devices. The contact pressures may be reduced either because of worn contacts or damaged contact springs. If contact springs have been overheated, they may be unable to provide sufficient contact pressure because the material has been weakened by the overheating. Contact pressures should be checked and maintained within suitable limits. Always replace both moving and stationary contacts.

Loose Contacts

Any loose electrical connection eventually will cause trouble. The bolts or fastening devices that hold contacts in place always should be tight. Normal expansion and contraction of metals due to temperature changes or excessive vibration will cause bolts or nuts to become loose. Frequent checking for loose contacts is advisable.

The life of oil immersed contacts is generally shorter than that of contacts operating in air. Frequent inspection of oil immersed contacts is important.

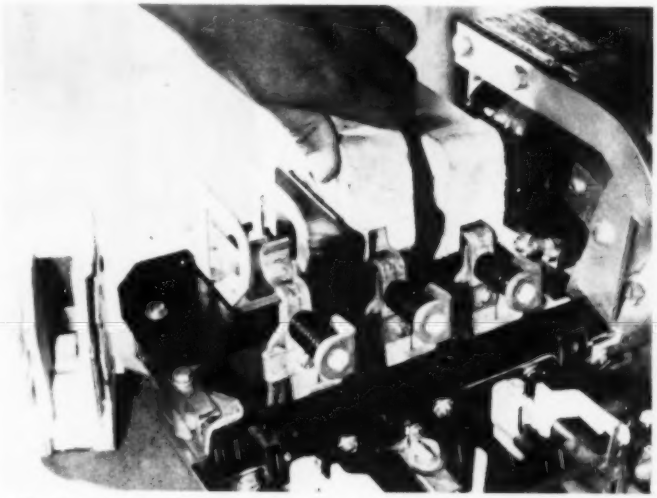
Welding of Contacts

Few contacts close without some bounce or rebound when they first come together. This is due to the reaction of the contact springs as they are compressed to provide the final contact pressure. When the contacts bounce they may separate. At this time the contacts are carrying current and, even though the separation be very small, an arc is created. This arc may cause sharp projections of burned or roughened contact surfaces to overheat and may weld or "freeze" the contact surfaces together. Other causes of contact welding are excessive current when contacts close or open, insufficient contact pressure, sluggish operation either when closing or opening, and momentary closure of contacts with little or no pressure applied.

Silver contacts will weld more readily than copper ones. Well-designed contacts, properly applied, reduce this hazard to a minimum.

Contactor and Relay Coils

Coils provide the electro-magnetic pull that causes the contacts of relays and contactors to open or close. Series coils generally carry heavy currents and have relatively few turns of rather heavy copper. Shunt coils have many turns of insulated wire. They are generally impregnated in a vacuum or under pressure with insulating compounds and are covered with insulating tapes or materials. The impregnating compounds produce a firm but resilient binding material that prevents cracks when temperature changes occur. The impregnation process eliminates air pockets within the winding, making the coil a solid mass that is better able to radiate heat and less subject to mechanical injury.



ARC-RUPTURING PARTS must always be returned to proper position after inspection

Shunt coils for a-c devices are designed to close them at 85% of rated voltage. Coils for d-c devices will close them at 80% normal voltage. Any coil may be expected to withstand 110% rated voltage without overheating.

A coil with an open circuit will not operate the contactor or relay. The questionable coil should be replaced immediately by one that is known to be satisfactory. The questionable coil then can be checked for open circuits.

If some turns of a coil become short-circuited, the resistance of the coil will be reduced and more current then passes through the coil. The increased current will cause higher operating coil temperatures and frequently causes coil burnouts.

Coils should be operated at rated voltage. Overvoltage on coils causes them to operate at a higher temperature that unnecessarily shortens coil life. Overvoltage also operates the contactor or relay with unnecessary force, causing more mechanical wear and bounce when closing.

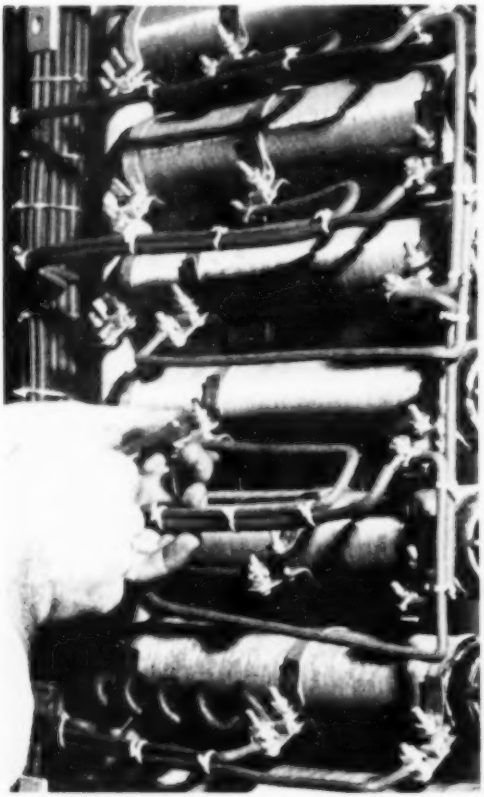
Undervoltage on coils causes contactors and relays to operate sluggishly. The contact tips may touch but the coils may be unable completely to close the contacts against the contact spring pressure. Under these conditions, the contact pressure is below normal and the contacts may overheat and weld together.

Due to the magnetic air-gap and the characteristics of a-c circuits, the coil current of an a-c contactor is much higher while the contactor is closing and the air-gap is larger than after the contactor has closed and the air-gap is zero. Since the closing time is short, a-c coils are designed to withstand the closed conditions. They soon will overheat if the unit is blocked, or if the voltage is too low to close it and the coil remains energized with the large air-gap in the magnetic circuit. Freely operating parts will avoid such coil burnouts. D-c coils are not subject to these conditions because the coil currents are constant at all times.

Arc Rupturing Parts

When contacts are expected to open circuits carrying currents that are difficult to interrupt, they are equipped with arc-rupturing parts. The arc-rupturing parts generally surround the contacts and must be so made that they are easily moved out of position, or removed entirely to inspect and replace both moving and stationary contacts. To be effective, the arc-rupturing parts must be in a definite position with respect to the contacts. Hence the arc-rupturing parts always should be returned to the proper position if removed for any reason.

The fine strands of flexible shunts sometimes break where the shunt



RESISTOR CONNECTIONS MUST STAY TIGHT: vibration can cause them to loosen

COIL TEMPERATURES can be checked with an ordinary thermometer

bends. The unbroken strands must then carry the entire current. If many strands break, the unbroken ones become overloaded, they overheat and eventually burn. Frayed shunts should be replaced.

Bearings

Contactor and relay bearings are designed to require no lubrication, except for bearings of master switches, drum controllers and similar units. If lubricated, the accumulation of oil and dirt in contactors or relays may cause sluggish mechanical action that impairs the arc-rupturing qualities of the device or causes welding of the contacts.

The moving parts of contactors and relays should move freely in bearing surfaces without any evidence of tightness or friction. Periodic inspections to avoid friction in the moving parts is desirable.

Devices sometimes move vertically and therefore have no turning motion. The motion must be guided, and the guiding surfaces are comparable to bearing surfaces. Friction or magnetic sticking at these surfaces should be avoided.

Some designs use knife-edge bearings. Here the opening and closing action of the device "wipes" the bearing surface, keeping it clean.

When operating coils are de-energized, some residual magnetism remains in the magnetic circuit. This residual magnetism sometimes is strong enough to hold the device closed after the coil is de-energized. This condition occurs most frequently on small devices on which contact spring pressures and moving parts are light. Magnetic sticking causes erratic, unsatisfactory, and sometimes dangerous operation. It can be avoided by adding a non-magnetic shim in the magnetic circuit.

Air or oil dashpots are used to retard motions. They are machined to close clearances and must be kept clean and free to move. The proper amount and kind of oil always should be kept in oil dashpots. Since the viscosity of oil changes with temperature, substitute oils should not be used.

When the voltage on the coil of an a-c contactor or relay passes through zero, its magnetic pull or holding power is zero and the device starts to open. The voltage, however, is soon effective in the opposite direction and the device is again pulled closed. This operation causes a humming noise in any a-c operated device and a decided chattering noise in a defective unit. The otherwise objectionable chattering is eliminated and the device is kept closed by the use of a shading coil, usually imbedded in the laminated magnetic circuit of the device. The shading coil produces enough out-of-phase-flux to provide holding power to maintain the device closed during the short period when the main flux is zero. Even with shading coils in use, the air-gap surfaces must be free from dirt and well fitted to avoid objectionable noise. Broken shading coils are ineffective and cause noisy operation.

For quiet operation of a-c contactors, it is necessary to provide well-

fitted surfaces at the air gap. Any dirt in this area introduces a greater air-gap when the unit is closed, increases the duty imposed upon the shading coil, and results in more noisy operation. To prevent rusting of the fitted surfaces at the air-gap, these devices are often shipped with a small amount of grease or oil on them. This lubrication may cause a "seal" that makes them sticky and sluggish in opening when first put into service. These surfaces, therefore, should be wiped clean before the units are placed in service.

D-c coils are not subject to a zero voltage condition, hence they are always quiet. For this reason, a-c current-carrying contactors equipped with d-c operating coils will operate quietly.

Loose Connections

Loose connections of any kind should always be avoided on electrical circuits and apparatus. An open circuit or an unreliable one may cause much lost time and production because they are often very difficult to find.

A loose connection causes a poor contact of high resistance generating heat. The copper oxide or discoloration increases the resistance of the contact surface, causing still more heating. The effect is always cumulative, and the heating increases until the parts overheat, deteriorate, or burn.

A loose connection on a thermally operated device, such as the heater of a thermal overload relay, may, because of the external heat developed near the heater, cause the overload relay to trip and stop a motor when the motor is not overloaded.

Loose connections frequently develop on the terminals of resistors, because the alternate heating and cooling of the resistors cause temperature changes enough to loosen the bolts or nuts that clamp the connections to the resistor terminals. Excessive vibrations also may cause loose connections. The fact that a connection was once tight is no assurance that it will remain tight. Periodic inspections are advisable.

Excessive Temperatures

Overheated parts always indicate trouble. It is, however, often difficult to know when temperatures are excessive.

Resistors are operated safely at 350° C rise above ambient temperature, but insulated coils generally are restricted to 85° C above ambient. Solid copper contacts are limited to a rise of 65° C and copper bus work to 50° C rise.

Copper parts that are very discolored have been or are too hot. When in doubt, temperature should be measured by thermometer or by other means. It is best to know what the permissible temperature is and then measure it.

Thermally-operated overload relays should be in approximately the same ambient temperature as the motors they protect. If the relay is in a higher ambient temperature than the motor, it will trip when the motor is not overloaded. If the relay is in the lower ambient temperature, it may not trip in time to protect the motor. If the ambient temperatures must be different, some compensation for the difference can be made by proper selection of the overload relay heaters, or by providing a relay that compensates for the difference.

Grounds

Grounds are both useful and undesirable. The desirable ones are maintained easily because they require only good contact connections. An unexpected ground, however, is a serious personnel hazard.

Constant vigilance is required to prevent and eliminate undesirable grounds. They cause operating troubles, erratic and dangerous operating circuits. Because of them motors may start unexpectedly; motors may not stop when they should; overload and other protective features may be made ineffective.

Grounds often occur in pushbutton boxes or similar confined spaces, where stray strands of wire may make contact at incorrect places. They occur when wires become chafed due to vibration on rough edges, such as conduit entrances. Conduits sometimes become wet from condensation or other reasons, and the insulation on the wires becomes waterSoaked and of low insulating value. Conduits should, therefore be installed so that moisture within them will always drain away. It sometimes may be necessary to remove the wires, clean the conduits, and install new wiring. Clean and dry conditions always reduce maintenance.

Summary

The following points are important for good maintenance:

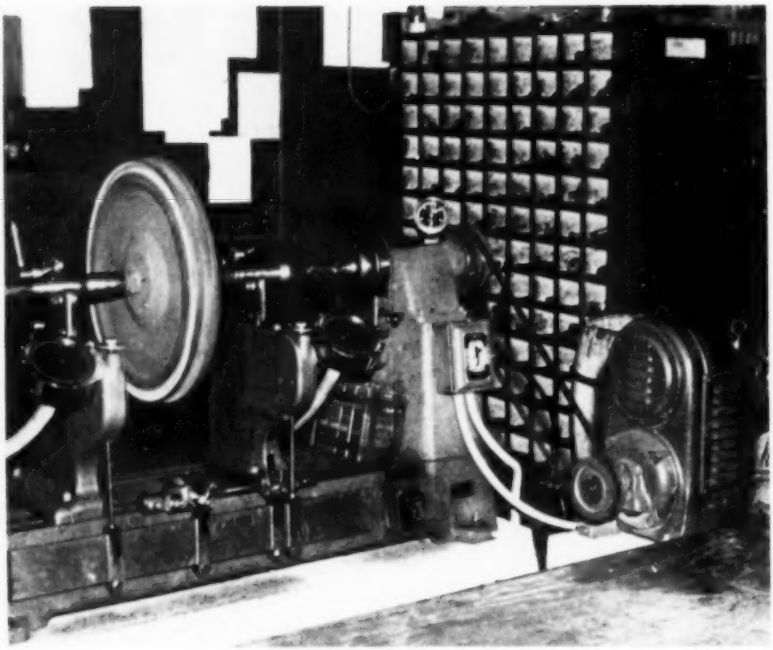
1. Do everything possible for the safety of personnel.
2. Initial installation should be tested and proved satisfactory before it is accepted.
3. An adequate supply of correct renewal parts should be available.
4. A systematic program of inspection and maintenance work should be used.
5. Enclosures should be chosen for operating conditions.
6. Keep controllers clean and dry.
7. Replace contacts that are worn very thin or badly burned and pitted. Replace contacts by pairs.
8. Maintain correct contact pressures.
9. Contacts should be kept clean. Do not change contact shape by rough filing or grinding.
10. Keep contacts and all connections tight.
11. Do not oil contactor or relay bearings, but keep these units clean and with no friction in the moving parts.
12. Operate coils at rated voltage. Both overvoltage and undervoltage conditions are undesirable.
13. Keep arc-rupturing parts in good condition and in correct operating positions.
14. Replace frayed and worn shunts.
15. Keep all dashpots clean. Be sure oil dashpots have correct oil in them.
16. Correct conditions that cause excessive temperatures. Measure the temperature if in doubt about overheating.
17. Be alert for undesirable grounds on all circuits and eliminate them.

NOTE: This article has been condensed from a forthcoming edition of the book "Controllers for Industrial Motors," by I. E. Markle and H. D. James, McGraw-Hill Book Co.

Meet the Author

I. E. Markle, manager, equipment division, control engineering dept., Westinghouse Electric Corp.'s Buffalo Works, has been associated with the company for 35 years. He joined Westinghouse after graduation from Penn State College in 1917 with a degree in electrical engineering. Except for a short initial training period, Mr. Markle's primary responsibility has been the design of controllers for electric motors.

He is co-author, with H. D. James, of the text "Controllers for Electric Motors," published in 1945 by McGraw-Hill Book Co. A larger and revised edition will be published this year. Mr. Markle is a member of the American Institute of Electrical Engineers and makes his home in Buffalo, N. Y.



EIGHT MONTH'S PAY-OFF is anticipated from this dynamic balancing machine shown with a rotating pump impeller under test

Profits from Dynamic Balancing

Rapid, accurate and safe test for wear and vibration in rotating parts of pumps or turbines

By R. W. LORTZ, Mechanical Supt.
Phillips Petroleum Co., Sweeny, Texas

UNBALANCED rotating elements in pumps, turbines, and other refinery equipment contribute greatly to excessive operating costs in terms of increased maintenance attention brought about by high wear rates or destruction of bearings, shaft sleeves, and close-clearance parts.

Phillips Petroleum Co., at its Sweeny, Texas, refinery is hanging up an enviable record in terms of parts cost reduction, reduced down time on equipment, and the freeing of mechanics for other important work through the use of a recently-installed dynamic balancing machine. The mechanical department is firmly convinced that a dynamic balancer is an essential item of shop equipment for a refinery.

There are approximately 425 pumps installed in this refinery, most of which run at 3000 rpm. or faster. Approximately 175 of these are steam turbine-driven. Material savings alone through dynamic balancing in the first year of operation are expected to amount to between 40 and 45% of the annual parts bill based on 1950 costs and warehouse withdrawal records on items affected by an unbalanced rotating element. These include impellers, bearings, shaft sleeves, packing, wear-rings and labyrinth rings. The labor cost generally equals or exceeds the parts bill. Considering only labor and parts, ignoring losses from product leakage and downtime on equipment, it is believed the investment will be amortized in eight months' time.

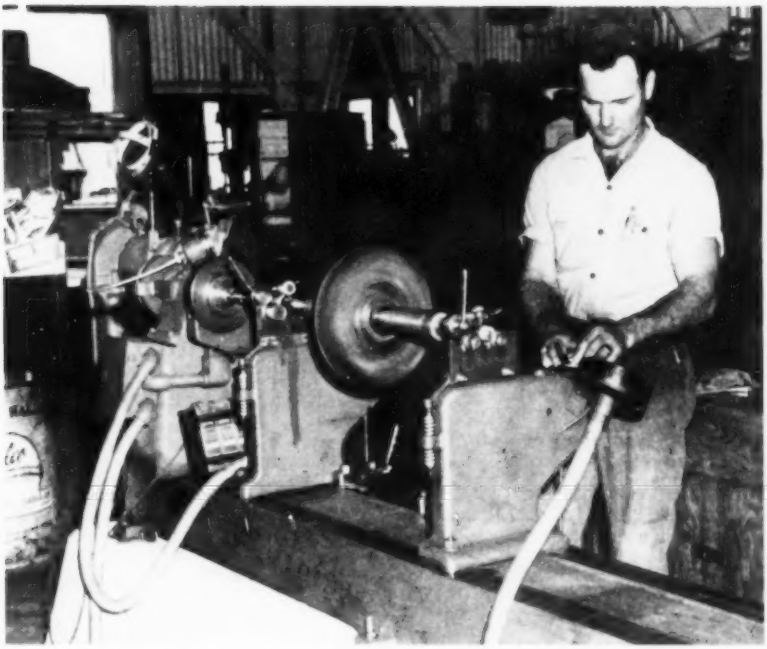
When equipment operates at high speed, common in turbines and a growing practice in design of centrifugal pumps, not only does bearing wear become excessive from the unbalanced forces which must be resisted, but severe vibration may develop which quickly ruins bearings and damages other parts.

Anyone who ever has driven an automobile with an unbalanced front wheel at high speeds has had at least a trying first-hand introduction to the forces and vibrations which develop. And more than one old-timer has run for his life when a wax centrifuge developed a bad case of "the shakes." several have been killed when these machines "exploded."

Manufacturers of rotating equipment are well aware of this. Customarily rotating elements are balanced dynamically, even when they are to operate at speeds below 3000 rpm., a value regarded by some authorities as well within the danger zone when dealing with unbalanced forces. This is all very fine until something happens to the equipment to throw it out of balance, such as corrosion, erosion, or parts replacement in rotating assemblies.

While it is good mechanical practice to true up and rebalance any rotating elements before reinstallation, the best which normally can be done is to balance it statically. Special equipment is required for dynamic balancing, an operation three times as rapid and capable of more satisfactory results than static balancing.

The machine selected by the Sweeny refinery is capable of dynamically



MECHANIC ADJUSTS SENSITIVITY to obtain location of maximum dynamic unbalance in pump impeller

balancing a rotating element weighing between 10 and 1000 lbs. (dead weight) and not more than 6 ft. long. Further limitations are shaft sizes ranging from 1 to 4 in. diameter, and elements up to 35 in. diameter. It will accommodate practically every element in the plant requiring balancing.

The balancer shown "in action" in the accompanying photographs consists of a variable speed driver connected to a chuck which holds the shaft of the element to be balanced. A tachometer on the chuck indicates revolutions per minute. Two assemblies carried on the bed provide bearing points for the shaft. They can be adjusted so that the portion of the element most likely to be unbalanced is properly centered between them. Each assembly carries a glow-lamp indicator graduated in 10° intervals. By this means, unbalance anywhere in the plane of the assembly is located through vibration carried to a sensing device in the assembly. "Locks" are provided to prevent vibration when desired.

Whenever possible, balancing is done at any convenient speed above the critical rotational speed of the element in question. More satisfactory results are obtained in this way. Sometimes, however, when the element is badly unbalanced, exceedingly heavy or unwieldy, below-critical speeds are used at least until the worst of the unbalance is corrected.

Critical speed is determined by increasing rotation until marked vibration is suddenly encountered, the intensity of which dies out rapidly as speed is further increased. This critical vibration point usually is so sharp that it is not necessary to look at the indicator, a hand on the bearings holding the item under test being sufficient except for small-diameter objects.

Once speed rises above the critical by any convenient value, the machinist locks out one of the two instruments and then reduces the sensitivity of the other until a single lamp or just a few somewhere on the periphery remains lighted. This single light or midway in the group if several are lighted is the point of maximum unbalance in the single plane in which the element is permitted to vibrate. A reference pointer is moved to this position. The other instrument then is put into action and the first locked out, restricting motion to a second plane, for determination of the second point of unbalance, if there is one.

The balancer now is stopped and the element rotated by hand until the indicator light glows at the point of unbalance previously located. Weight may be either added or subtracted, depending on how the measurement was taken. The former follows from the fact that any force may be opposed (neutralized) by an equal and opposite force. Since any unbalance can be represented by a mass at some distance out from the center of rotation, removing mass at this or an equivalent point will effectively oppose the original unbalance.

Phillips' machinists generally prefer to remove weight, usually by countersinking one or more holes, rather than to add weight. This is because the hole causes little impairment of mechanical strength, and cannot be knocked off or displaced during installation or operation.

Rough balancing done, the machine is again started to check results. Depending on how nearly accurate was the mechanic's judgment in the first balancing, one or more rebalancings may be required.

In the mind of the casual beholder, there is always doubt that balance has been achieved, or the true point of unbalance accurately located. For demonstration, a piece of straight shafting may be chucked into the machine as if it were the rotor of a centrifugal pump, and a gob or two of plasticine firmly attached. In such a demonstration, where the point or points of unbalance are unquestionably known because the bare shafting is already in dynamic balance, the demonstration is unfailingly convincing when the reference pointers persistently return to the obvious mounds of clay, following the direction of the indicating instruments.

Dynamic balancing machines are manufactured by several concerns. The machine shown in the photographs is a Model NEH-136, manufactured by the Globe Tool and Engineering Co., Dayton, Ohio.

Dynamic balancing equipment is being used at a number of other Phillips Petroleum Co. plants, including the Phillips, Texas and the Kansas City, Kans., refineries.

THIS TOWER IS NO GOOD-- AND YESTER-DAY THE FAN SUCKED MY HAT INTO IT!
GIVE ME STRENGTH!
THAT'S AN INDUCED DRAFT TOWER YOU'VE GOT THE FANS REVERSED!

No. 7 in a series on How to Order Equipment

How to Get What You Need When You Order Cooling Equipment

By D. P. THORNTON, Jr., Southwestern Editor

COOLING equipment is a "must" item in every plant processing petroleum hydrocarbons, whether natural gasoline plant, refinery, petrochemical operation or natural gas pipe line. Despite its obvious importance, cooling facilities are purchased more often than not with less consideration than usually is given to most other custom-designed equipment, many suppliers believe.

Cooling equipment is sometimes misapplied, frequently severely mistreated and often ignored until it gives trouble. This, in turn, can adversely affect the customer-supplier relationship by resulting in accusations which are not always supported by the facts. In view of the capital investment usually involved and the relatively lavish maintenance attention given other mechanical equipment items, this situation seems surprising.

Refinery cooling equipment generally has one strike against it from the start. Keeping the cooling water free of oil, dirt and other contaminants is very difficult and either oil or dirt quickly lowers tower efficiency.

The tale is told of one large oil company which makes no bones over refusing maintenance attention to cooling towers beyond lubricating moving parts of mechanical draft towers. It reportedly considers tower replacement every three or four years cheaper than lost unit production time resulting from periodically turning it around.

Much of the trouble attributed to cooling towers could be avoided by supplying complete details of requirements when the tower is bought and drawing on the manufacturer's experience in preparing specifications which give this information. This is not to be construed in terms of excluding potential bidders with hidden jokers, but rather to weigh adequately in advance the specific conditions of service, geographic and plant location, and conditions external to the tower which affect its performance.

Cooling towers, like pumps, valves and heat exchangers, are not peculiar to the oil and chemical industries. Consequently, experience gained "the hard way" by tower manufacturers in applying his equipment to other industrial environments may be readily and profitably translated to hydrocarbon processing service.

Types of Equipment

Although this article is not a guide in one easy lesson to the selection of cooling equipment for a specific application, the several types of equipment are briefly reviewed before discussing pertinent details having a direct connection to information which should be furnished with invitations to quote or purchase orders.

Two general classifications of cooling equipment are treated: the cooling tower and the air-cooled exchanger. Both reject heat to the atmosphere but, involving different physical principles, vary in design information requirements. Spray ponds are becoming less common and have been excluded from treatment; in general, requirements are similar to natural draft cooling towers.

Selection of the basic class of equipment may be dictated by their physical principles and limitations, economic grounds, or availability and quality of make-up water. All should be carefully evaluated for the individual case.

There are two basic types of cooling towers: natural and mechanical draft. The latter is sub-divided into forced or induced draft. The natural draft tower usually is the larger of the two for equivalent heat dissipation and wet bulb approach, has a lower total power and operator attention requirements. Wind velocity and direction markedly affect performance.

Mechanical draft towers are more independent of wind velocity and direction, require less space than the corresponding natural draft tower. Control of cool water temperature is easier and more flexible; power costs are higher. There are good arguments of both sides of the controversial question of induced vs. forced draft, the resolving of which is beyond the scope of this article; both are capable of yielding satisfactory performance.

The "air-cooled exchanger," or "air-cooler," is not a cooling tower in the technical sense as it depends solely on direct heat transfer between air and the material to

be cooled. The automotive radiator is a typical example. Hence many of the purchasing considerations discussed in an earlier article on heat exchangers[1] apply.

Air-cooled exchangers are inherently unable to reduce the temperature of a hot fluid below the atmospheric (dry-bulb) temperature and in practical applications do not approach it closer than 20 to 30° F. Usually they are used to cool fluids directly and handle water when "cool" temperatures are acceptable at levels considerably above those produced by the cooling tower. The closer the approach to the ambient air temperature, the greater the size and cost of the unit.

Among advantages are high operating flexibility, entering fluid temperatures limited only by materials of construction, and immunity from winter troubles unless the liquid being cooled will freeze or lubricants used in mechanical parts will congeal. They may be located anywhere in the plant and there is no spray carryover to corrode and damage adjacent facilities. Properly constructed and operated, they are no more a fire hazard than other items of operating equipment (fires have occurred in the coil sheds of water cooling towers).

Buying Tips

There are a number of things which buyers can do to save money in buying cooling equipment and still assure themselves of receiving satisfactory performance from their purchase. Topping the list is reliance on recommendations of the equipment supplier for a given application. But the supplier must have all the facts.

One prominent cooling tower manufacturer candidly states that he considers an inquiry principally "as notice that this customer *thinks* he needs a cooling tower." Thereafter, he adds, it's up to us to find out what he really needs, or wants—and he may not need a cooling tower at all."

Theoretically, all a manufacturer needs to know to quote on or design a cooling tower is the basic information, namely:

1. Volume of water to be handled.
2. Maximum temperature of the hot water.
3. Temperature of the cooled water.
4. Design wet-bulb temperature of the air at location.

Even so, invitations to quote containing inadequate data, like the following received from a large oil company, are not uncommon: "Please quote your best price for a 35,000 gpm. cooling tower, wet bulb approach 10° F., induced draft type preferred."

Here It Is Again

When we first began this series on "How To Order Equipment" a year ago, we intended to limit it to the more common "catalog" types of equipment. Interest in the articles has been so great, however, that we asked Dave Thornton, the originator, to look around and see if he could put together similar stories on other equipment and material used in petroleum processing plants.

The first result is the current article on cooling equipment. Others will follow on such items as motors, insulation, and the like. But don't look for them in consecutive issues; as rapidly as Dave is able to get the data assembled, he'll feed it to you.

By the way, in case you missed the announcement on the "Publisher's Page" this issue, the earlier articles won a "certificate of merit" as one of the most outstanding series of articles published in industrial papers during 1951.

Wet-Bulb Approach

The wet-bulb approach (difference between cooled water and design wet-bulb temperature) never should be specified lightly. This is the most important single factor determining tower size and cost. The closer the approach the larger the tower, all other factors being equal. The temperature of the cooled water therefore should be set as high above design wet-bulb as process requirements will permit.

The effect on size may be illustrated by assuming conditions of constant cooling range, wet-bulb temperature and air flow. If a 10° approach is considered the standard for comparing relative tower sizes, then going to a 5° approach will increase tower size 80%. On the other hand, increasing the approach to 15° will reduce tower size 30%.

Some manufacturers believe that refinery customers often specify unnecessarily close wet-bulb approaches, especially in the humid areas of the Southwest. Along the Gulf Coast a common requirement is 85° F. cold water, necessitating a 5 or 6° approach. Granted, there are numerous refinery and chemical plant services amply justifying 5° and even 3° approaches in terms of heat exchanger cost or product recovery, but not *all* cooling requirements in the refinery are this severe.

One manufacturer, in discussing this with the author, believes considerable sums could be saved in first cost as well as operations by constructing two or more cooling towers to handle the different requirements in a tailor-made split-flow arrangement. Also, it is simpler to install several 6-in. or 8-in. cooling water mains than to find room for a 20-in. distribution loop. Such an arrangement also acts as insurance against total coolant failure in event of tower difficulties and has other operating advantages.

In a case where only 10% of the total coolant circulation need be 85° F.—a not uncommon situation—and the remainder is acceptable at 90 or 95° F., for example, he showed that a single small tower for the coldest water and another for the warmer supply would cost less, installed, than an equivalent single tower bringing the total coolant circulation to a supply temperature of 85° F. Operating costs also were reduced.

Split-flow arrangements also are possible with a single tower, based on the fact that water falling nearest the outside of the tower is cooler than that in the central portion. This follows because the air passing through the tower becomes progressively more humid and also is sensibly warmed. Some manufacturers can supply dual collecting systems to segregate this cooler water if the customer desires.

It is optional with the manufacturer whether or not he is willing to act as a consultant in developing desirable split-flow arrangements. Some will cooperate with the customer's process engineer if requested; others prefer to leave this responsibility solely with the customer.

Design Wet-Bulb Temperature

A common although often unappreciated cost-booster is the selection of design wet-bulb temperature. It should be determined with economic as well as process considerations in mind, the manufacturer will assist gladly. Ordinarily it is not the highest wet-bulb temperature recorded by the U. S. Weather Bureau or other accurate source over several previous years for the area, but a value exceeded only for a few hundred *annual* operating hours and occurs for short daily periods during summer. Generally a net saving will be achieved by accepting slightly warmer water for brief intervals rather than buying and operating an oversized tower most of the time. How much time "off-specification" water temperatures can be tolerated is the customer's decision, but an important one.

It also is well to remember that location in the plant can have an effect on the wet-bulb temperature as well

as the "fresh air" supply to the tower. If, for example, the tower must be located down-wind from operating units the air very likely will be warmed, affecting both wet- and dry-bulb temperatures. If down-wind from an existing cooling tower, very likely the wet-bulb temperature will be greatly increased, the dry-bulb a lesser amount.

Several manufacturers request accurately-scaled plot-plans from customers for this reason. This should show the location of the proposed tower, nature of adjacent equipment and its height, direction and velocity of prevailing wind. If possible it should show location of future equipment and buildings. This is not an attempt to pry into the customer's affairs but to help the manufacturer design equipment yielding satisfactory performance for longer than the customary 12-month guarantee.

Another factor affecting tower design is the water to be used, a matter over which the cooling tower manufacturer has no control but which may have a definite effect on tower life. Is it clean, dirty, oily, acid or alkaline, and how much? If the problem is known in advance, sometimes provisions can be made in design or construction materials, in fabrication, or perhaps maintenance suggestions. Possibly the continuing services of a competent water chemist will be the only way to satisfactory service.

Design Tolerances

Unquestionably buyers have heard that tower manufacturers now use closer tolerances in estimating tower performance than formerly. This is correct and generally they are less than 5%, due to extensive research, experience and the pressure of competition. The actual factors are considered confidential but the net practical result to the buyer is a tower "right on the nose" of his requirements, without needless allowance for "guesses."

Unfortunately, the buyer may pad the heat load to be dissipated in fearing the designer may "figure too close" and the resulting tower will be inadequate. Padding design data today is a good way to waste capital and perhaps bring on the very result which the padding was intended to offset.

In this connection there is a minimum water rate, represented by the depth of water in the distributing system. Going below this gives rise to "channeling" or improper water distribution and results in "short-circuiting" of the tower; it shows up as poor performance. In overloading, the tower becomes flooded and effective water surface exposed to the air is reduced; the net result is the same.

The best protection for the customer is to agree in writing with the manufacturer upon a performance test designed to show whether or not he gets what he paid for. It will save a lot of argument later and be fair to both sides.

There are several such tests, one of the latest being that of the Cooling Tower Institute[2] covering mechanical draft towers. Copies of the test and test forms may be procured either from the Institute secretary or members. A subcommittee of the ASME Power Code Committee now is revising and modernizing the existing "Atmospheric Water Cooling Equipment" code adopted in 1929.

Such tests also are valuable in operations to establish need for maintenance and to prevent mis-performance claims resulting from improper operation. Not long ago a field representative investigating such a complaint uncovered a classic example of improper operation of an induced-draft tower. As he headed for the latter he was told to hang onto his hat lest it be *sucked into* the tower by the fan! When he recovered from his astonishment and got the fans reversed, tower performance became satisfactory. (Operating instructions later were found buried in the customer's files, unread.)

In addition to performance tests, it also is advisable to require guaranteed performance curves covering varying anticipated conditions. In this connection, one manufacturer is of the opinion that the curves as requested by many customers are "very pretty" but are not of the value they should be in practice.

He believes the customer's principal interest is in the cooled water temperature at various wet-bulb conditions at specified cooling ranges (heat loads) above and below design. For large towers (over 1500 gpm., usually) individual curves covering 110%, 100%, and 90% of design flow are sufficient; a single curve at design flow should be adequate for smaller (below 1500 gpm.) towers.

It is well also to require rather complete and specified descriptive information on tower construction (however, do not ask for detailed structural design drawings for a specific tower unless an actual order is being placed), water distributing system, filling, power requirements and other particulars. Requesting price breakdowns is suggested. If all these are standardized as to bid requirements, evaluation of quotations by several manufacturers on a fair, comparable basis will be greatly simplified.

Some customers specify a noise level for mechanical draft equipment. However, as one manufacturer points out, they often are rendered meaningless by the way they are written and, in the usual refinery or chemical plant, are not necessary anyway. A definite noise level should be specified when the ambient noise level also is a definite value. Often specifications call for a noise level not to exceed, say, 50 db. (decibels *over* ambient. If a noise level is definitely not to be exceeded, such a requirement is meaningless. Assuming for illustration that ambient noise already is around 70 db. (equivalent to a busy street), a 50 db. *increase* will raise total sound to the level expected in a boiler shop!

The listing of information to be supplied in purchasing cooling towers and air-cooled heat exchangers and in bid invitations has been developed from a representative selection of manufacturers. They will cover most cases. While they call for considerable care in preparation, their suggested use will speed up submission of quotations, help assure a satisfactory piece of equipment and, in the long run, save time and tempers for all concerned.

Data required when ordering air-cooled heat exchangers

VITAL INFORMATION, all towers:

1. Water circulation rate: state units (preferably U. S. gal. per min.).
2. Hot water temperature, °F.
3. Cooled water temperature, °F.
4. Design wet bulb temperature, °F. Specify where to be measured (general vicinity of tower inlet, Weather Bureau, etc. See text). Preferably take readings in general area of tower, windward side, under extreme conditions.)
5. Type of tower.
   a. Specify: atmospheric; mechanical draft. (If manufacturer builds both and buyer has preference, also specify induced or forced draft.)
   b. If coil shed required, specify. (See additional information requirements below.)

DESIRABLE SUPPLEMENTARY INFORMATION, all towers:

1. Type of water: specify "clean" or "contaminated." (If other than "clean" state nature and quantity of contaminant. If a "problem" water is involved, it is ad-

visable to supply an analysis. Performance guarantees usually specify clean water and tower internals.)

2. Maximum permissible drift loss (generally 0.2% of design water circulation).

3. Wind loading requirement, if other than manufacturer's standard. (Generally applies to areas where high winds or hurricanes are prevalent. Usual minimum value is 30 to 40 lbs. per sq. ft., may be higher in hurricane areas.)

4. Plot plan, to scale, showing space available for tower and other equipment in near vicinity.

5. Direction and velocity of prevailing wind. (Design velocity should be stated if not shown on plot plan. Performance guarantees usually void when surrounding structures obstruct entering air or vapors from them interfere, if such circumstances are not stated in advance.)

6. Maximum pumping head available at hot water conditions, if any. (This generally applies only when replacing an existing tower. Otherwise it will be assumed customer's pump can supply a tower of any commercial height. Limitation is an important factor in sizing tower height and specification can make a difference in number of cells required, increasing cost.)

7. Advise contemplated depth of tower basin. (Sometimes this can be used to reduce size of tower if a sufficient volume of water is to be stored for emergencies.)

8. If "split-flow" arrangement contemplated, specify also required quantity of coldest water and allowable maximum for warmest water. Allow supplier option to quote two towers. (Some manufacturers offer consulting services on "split-flow.")

9. Specify performance test required and test conditions.

10. Specify design data requirements, if any, to accompany bid. (These may include various performance curves, structural codes, data on number of cells and their dimensions, filling details, water concentration, air rate, etc.)

11. Specialized construction requirements or standards. (Generally optional with customer. May include such provisions as single wall construction to minimize wood deterioration, etc. Advise when special soil bearing load problems are involved, although most tower manufacturers do not design foundations.)

12. Access requirements (ladders and stairways, doors, walkways and their construction.)

13. Specify what work and equipment will be furnished by *customer*. (Usually includes basin and tower foundation; anchor bolts; unloading and hauling of materials to jobsite, although some manufacturers prefer to handle unloading if furnishing erection; electric wiring; piping external to tower, and motor starters and controls.)

SUPPLEMENTAL DATA for coil shed towers:

In addition to the foregoing listing of information the customer should advise:

1. Number of bays of coil shed required.

2. Maximum number of coils to be installed in any one bay.

3. Height of coil shed door. (Depends on number of coils and whether vertical or horizontal sections are used.)

DESIRED SUPPLEMENTAL DATA for mechanical draft towers:

In addition to data listed above as basic information and that for all types of cooling towers, the following information is desired:

1. Fans.
   a. Pitch: adjustable or fixed. (Most manufacturers supply adjustable type as standard.)
   b. Material of construction (if preference important).
   c. Maximum diameter and or tip speed. (Some manufacturers recommend maximum tip speed of 11,000 ft. per sec. Diameter should not be specified without good reason; if too small the number of cells may have to be increased to secure adequate air.)
   d. Minimum number of fans (if known). (At least two preferred for critical services.)
   e. Make (only for good reason; may involve procurement difficulties, delay delivery).

2. Fan Drives.
   a. Type of driver. Specify:
      1) Electric motor.
         a) Power characteristics (AC or DC, voltage, number of phases, cycles per second).
         b) Type of enclosure (specify whether (1) totally enclosed or (2) totally enclosed, Class 1 Group D explosion-proof).
         c) Single or dual speed. (Latter at extra cost.)
         d) Specify if tower manufacturer is to supply controls. (Ordinarily supplied by customer at less cost.)
         e) Avoid specifying make unless for special reason, such as plant "standardization", may involve procurement difficulties.
      2) Steam turbine.
         a) Steam characteristics (quantity, lbs. per hour; quality or degrees superheat, pressure, state whether gage or absolute).
         b) Exhaust pressure (state whether gage or absolute).
         c) Special requirements. (Includes make when there is special reason; low water rate, even if increases driver cost; special driver construction to meet customer's standards, etc.)
   b. Speed reducer. (Applies only to gear types.)
      1) Specify whether or not reversible feature desired.
      2) Make, when different from manufacturer's standard. (Avoid this when possible; may involve procurement and other difficulties. Most manufacturers supply spiral bevel types.)

3. Noise level, db. sq. cm. (Do not specify at all unless important, then require a specified number of decibels with all fans operating, measured at a definite location with respect to the tower when ambient noise is at a stated value.)

4. General.
   a. It will help manufacturer in quoting alternate arrangements if he is given:
      1) Average power costs for pumping and fan power.
      2) Pump characteristics for determining pump horsepower.

3) Incremental installed cost of tower basin 100 sq. ft. of plan area. (Tower height may be increased to reduce basin cost, etc.)

b. It is advisable not to limit manufacturer by specifying a maximum tower area or height. This may result in more cells, greater cost, etc. The detailed plot plan previously listed is particularly helpful.

c. Be sure to supply manufacturer with copies of appropriate plant or company standards, with latest revisions, if there is any reason to believe these may not be available to him.

Data required when ordering air-cooled heat exchangers

VITAL INFORMATION:

In general, the information required for this type of cooling equipment involves the data listed in an earlier article[1] on heat exchangers, since this equipment differs from the conventional exchanger only in that a fan moves air past the tubular element (generally finned to increase heat transfer surface on the vapor, or air, side).

The "shell" of the air-cooled exchanger is open on two sides of the tubular element. As in the coil shed cooling tower, with suitable headering a single element may handle two or more different fluids. As in cooling towers, there may be more than one cell, arranged as the customer desires or available space dictates. Certain accessories are available for this equipment which are not appropriate for cooling towers.

For convenience, the applicable data discussed in the article on heat exchangers has been repeated, somewhat abridged and omitting explanatory notes. Specific data for air-cooling has been added.

Heat Exchange Data:

1. Name of fluid or fluids if physical characteristics are well known; otherwise specify.
   a. Liquids.
      1) Specific gravity or density at stated conditions.
      2) Specific heat in Btu./lb. at two temperatures (for supply curve).
      3) Viscosity in stated units at two temperatures.
   b. Vapors.
      1) Molecular weight.
      2) Latent heat Btu./lb. at two or more specified pressures.
2. Dry bulb temperature of ambient air at cooler location (thermometer temperature). (Equivalent importance to design wet-bulb for cooling towers and selected with same principles in mind. Ordinarily, difference between this and temperature of cooled liquid—dry bulb approach—should not be less than 20 to 30° F.)
3. Temperature of fluid, in and out, °F.
4. Quantity of fluid to be handled, under stated units and conditions.
5. Pressure:
   a. Operating.
   b. Design.
   c. Maximum permissible pressure drop.

Desirable supplementary information includes: presence of solids in dirty liquids (quantity, nature and particle size if known); fluid velocities of dirty liquids; scale or coke-forming tendencies; maximum temperature and pressure under emergency conditions; corrosive nature of fluid and resistant materials if known; and fouling factors when known.

VITAL INFORMATION, construction data:

1. Materials required for:
   a. Tubes and fins. (May be clad or bimetallic tubes. Specify fin material.)
   b. Headers.
   c. Corrosion allowance, tubes and headers.
2. Connections to headers. (Specify size inlet and outlet; flange series and drilling.)
3. Outside diameter and gage of tubing (only if plant has standard for inventory control purposes).
4. Applicable code.
5. Specify induced or forced draft if customer has preference.
6. Maximum height of structure (specify only for special reasons).

DESIRABLE SUPPLEMENTAL INFORMATION:

1. Fans and fan drives. (Same as called for in Items 1 and 2, Desired Supplemental Data for Mechanical Draft Towers. Some units may be driven with hydraulic motors or internal combustion engines; contact manufacturer for data required.)
2. Advise if performance test required and give details of test conditions with purchase order.
3. Plot plan and direction of prevailing wind.
4. Design temperature and pressure (for safety reasons).
5. Special requirements as to wind loading if different from manufacturer's standard.
6. Access and safety enclosure requirements.
7. Accessories. (Includes louvres for air flow control to dual-speed drivers, by-pass controls motor starters.)
8. Specify what work to be furnished by customer.

"COMBINATION" Units:

A combination of the mechanical draft cooling tower with the air-cooled heat exchanger in a single structure has been announced by one manufacturer. For the design of such equipment, this manufacturer needs to know the total heat dissipation of the plant and therefore a heat balance is necessary. Since the design is new, it is recommended the manufacturer be contacted directly.

References

(1) Thornton, J. P. Jr., "How to Get What You Need When You Order Heat Exchangers," PETROLEUM PROCESSING, 6:5, p. 1128-1132.
(2) "Acceptance Test Procedure for Mechanical Draft Towers," Form TSC-101, Cooling Tower Institute, Banning Bldg., N. J. (August 1951).

Want a Reprint for Your File?

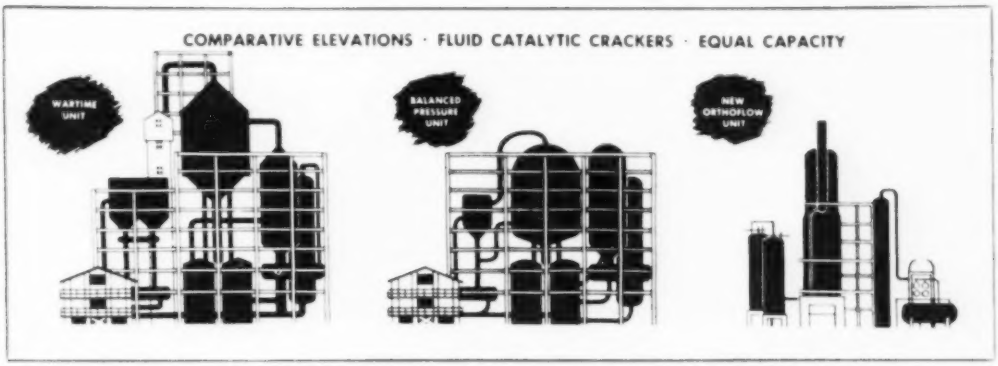
You can have a reprint of this article on "How to Get What You Need When You Order Cooling Equipment" for your personal file. Single copies are available without charge from:

Reader's Service Department
PETROLEUM PROCESSING
1213 West Third St.
Cleveland 13, Ohio

Reprints of the previous six articles in the series are also available, as follows:

Valves (Nos. 1 and 2, July and Aug., 1951)
Pumps (No. 3, September, 1951)
Heat Exchangers (No. 4, October, 1951)
Instruments (No. 5, November, 1951)
Compressors (No. 6, December, 1951)

Price quotations for quantities on request.


COMPARATIVE ELEVATIONS · FLUID CATALYTIC CRACKERS · EQUAL CAPACITY
WARTIME UNIT
BALANCED PRESSURE UNIT
NEW ORTHOFLOW UNIT

ALL EQUAL CAPACITIES but smaller structures features the development of today's Orthoflow FCC unit

Evolution of a Fluid Cat Cracker

ORTHOFLOW, the most recent development in Fluid catalytic cracking unit design, represents the continuing trend toward smaller structures with no reduction in throughput or efficiency and with lowered maintenance. Utilizing so-called "single vessel" design, its simplified arrangement permits straight line vertical flow of catalyst between reactor and regenerator.

Shorter catalyst lines located inside the combined vessel, simplified structure, and smaller foundations are the direct results of the new design. In addition, it has been possible in some cases to use only one internal head, since no space is needed between reactor and regenerator.

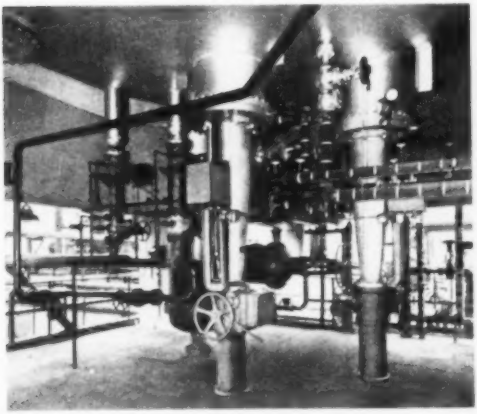
Process-wise, introduction of spent catalyst into the regenerator bed above the grid elimina'es the friction drop of one grid in the catalyst circulation system.

Maintenance-wise, expansion joints have been omitted. To make this possible, catalyst flow is controlled by specially-designed, spring-loaded, plug, or needle-type, valves. The one which introduces oil and catalyst into the reactor feed line is unique in that it controls catalyst flow while simultaneously the entire oil charge flows through its hollow stem. The other valve controls spent catalyst flow. Both are under automatic control, with manual optional in case of emergency.

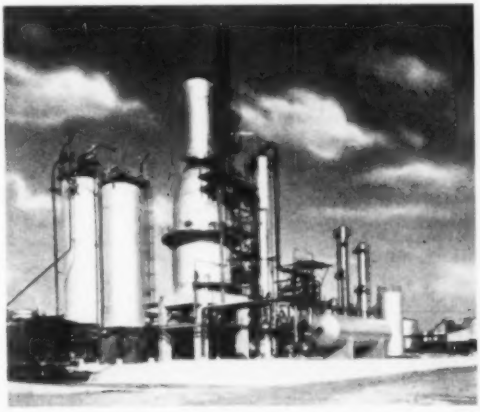
The first Orthoflow unit built of 2500 b/d design capacity has been on stream about nine months at the British American Oil Co. Ltd. refinery in Edmonton, Alberta. During that period operating on a mixture of heavy coker and virgin gas oils it has had a stream efficiency of over 94%.

The second unit to start up was the 8300 b/d plant at Cities Service in Ponca City, Okla. A third, also 8300 b/d, has just gone into operation for Canadian Oil Refineries Ltd. in Broomfield, Ont. Two larger units are now building for Pure Oil, 17,000 b/d at Toledo and 26,000 b/d at Smith's Bluff. A sixth at 5000 b/d is being designed for a European refinery, and Atlantic Refining Co. has just ordered the seventh, for installation at Philadelphia, with a fresh feed capacity of 28,000 b/d the largest to date.

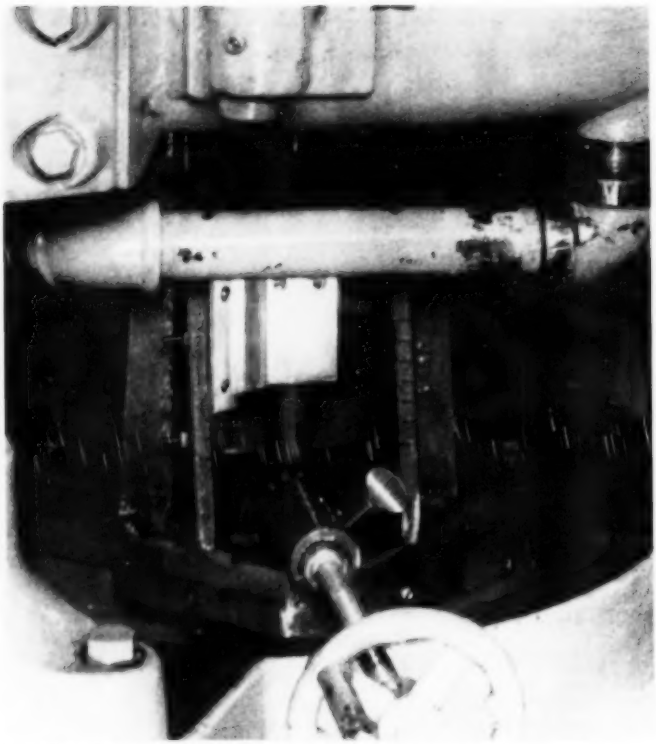
The Orthoflow design is a development of the M. W. Kellogg Co., which is engineering and building the units



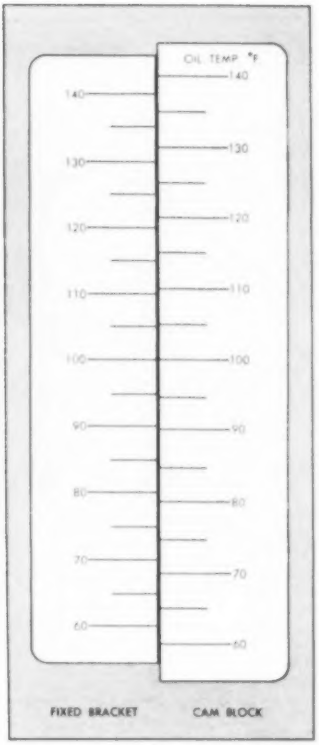
NEW TYPE PLUG VALVES for controlling catalyst flow are a novel feature, permitting omission of expansion joints and lower maintenance costs



COMPACTNESS IS demonstrated in this first Orthoflow in the United States, an 8300 b/d unit built for Cities Service at Ponca City, Okla.



REDUCTION IN AVERAGE OVERFILL is obtained by simple vernier attached to cam adjustment on filling machine



PRECISE VOLUME SETTING BY TEMPERATURE is made by this vernier for one-quart units

Want Lower Costs on Can Filling?

Gulf estimates savings up to $54,000 yearly possible by reducing average overfill 1% by volume

SUBSTANTIAL cost savings can be realized through precise volume control of lube oil can filling, using a vernier device developed by Gulf Oil Corp. When average "overfill" is reduced as little as 1% of a quart, savings will range from $54,300 yr. with 2½ qt. oil to $10,800 yr. with ½ qt. oil it is stated.

These facts were brought out in a recent report[1] by Bob Mellon, statistical engineer, and Richard Beck, package dept. foreman, at Gulf's Philadelphia refinery. Control is obtained by a vernier adjustment of the cam track on a one-quart, nine-pocket machine which meters oil by displacing it with pistons whose movement is controlled by the cam. The comparatively simple device is shown in the photograph and the vernier in the sketch.

Gulf's problem, according to Mellon and Beck, was to assure that each can would contain at least one quart, plus whatever drainage allowance company policy specifies. Anything in excess of this minimum is an economic waste for both the consumer and the supplier, since the difference is too small to affect a crankcase oil change or addition. It has, however, a real effect on cost to supplier, as indicated in Table 1.

In this table, it is assumed that the filling rate is 200 cans minute, which is equivalent to 71 bbl. hr. Each 1% of unnecessary average overfill is equivalent to 0.71 bbl. of oil wasted each operating hour. Whether any of this potential saving can be realized depends on evaluation of potential control. That is a problem in variations, and therefore requires statisti-

Table 1—Value of Filling Control When Average Overfill Is Reduced 1% of Quart

Oil Value $ qt.	Oil Value $ bbl.	Savings $ hr.(1)	Savings $ yr.(2)
0.375	8.40	5.96	10,800
0.50	11.20	11.92	21,700
0.75	16.80	23.86	43,400
0.75	42.00	29.82	54,300

(1) When filling rate is 200 cans/min. 171 bbl./hr. Therefore 1% average overfill is 0.71 bbl./hr.

(2) When operating 7 hrs./day, 5 days/week.

(1) "The Control of Lube Oil Can Filling," by Bob Mellon and Richard Beck, Gulf Oil Corp., presented before the Packaging Division, 13th Annual Forum, October 22-24, 1951, New York City.

cal methods — so-called "Statistical Quality Control" techniques.

It might be expected that the average volume delivered to each can would be affected by such factors as temperature, viscosity, and API gravity of the oil, and machine (cam) setting. A detailed statistical survey during normal operation of the filling machine indicated that the only variable directly affecting volume delivered was machine setting. This means that if the machine is properly adjusted for different filling temperatures, it will deliver the same average volume of any grade of oil when corrected to 60° F.

The precision required for machine adjustment is in the range of approximately 0.005 inches in the cam setting. This is accomplished by a vernier with one scale on the movable cam adjusting block, and the other scale on the fixed bracket of the machine as illustrated in the photograph. The vernier is calibrated in °F. In operation, the cam is moved until the vernier scales coincide at the oil temperature. The drawing shows the design of the vernier for a one-quart machine with 4.125-in. diameter pistons. Oil temperature range provided for is 60 to 140° F. Length of the fixed scale is 2.261 in., that of the movable scale is 2.412 in. Setting in the drawing is for an oil filling temperature of 95° F.

The statistical quality control technique used in evaluating control of can filling considered the following variables:

1. Variations in weights of empty cans with lids.
2. Variations in API gravity of oil of one brand and grade.
3. Variations in volume of oil sealed into cans by the filling machine due to inherent machine construction and operation.
4. Variations in weight of a fixed volume of oil filled due to changes in temperature of the oil delivered to the filling machine.
5. Variations in setting the cam position by the operators.

The study was begun with the machine in normal operation. Samples were taken in groups of five filled cans selected randomly within a minute or two and each group spaced 20–30 minutes apart. It was suspected that the empty cans might not vary uniformly, so samples of empty cans and lids were taken in the same manner. Charts, or so-called "scatter diagrams," were then drawn up of the various recorded weights of full and empty containers.

Potential best control that the machine could accomplish was then estimated at approximately 0.2% of one quart by statistical techniques and formulas. Further statistics then were gathered under various conditions and revealed that the average volume delivered to each can is affected by no other variable than the machine setting. The final design of the vernier was therefore made so that when its reading in °F. corresponded to the temperature of the oil being filled, the average volume at 60° F. would be constant.

After the vernier is installed, it is necessary to adjust the position of the vernier scales so that the average amount of oil delivered will provide the desired overfill. This is accomplished by selecting at random 48 filled cans and simultaneously selecting 48 empty cans and 48 lids. The total weight (measured to 0.5 ounce) of the filled cans less the total weight of the empties and lids is an estimate of the average weight of the total oil in the 48 filled cans.

If the API gravity of the oil is determined (using a standardized hydrometer) and the temperature of the oil at the time it passed through the filling machine is known to within 2° F., the average volume of oil delivered to each can will be estimated by the following formula:

$$V_x = (1/48)\,(Y)\,(1/G_{60})\,(1/M_x)$$

where:

- V_x = Average volume, in quarts, that the machine delivered to each can at the filling temperature for vernier reading x.
- x = Reading of the vernier.
- Y = Weight, in lbs. (within 0.5 oz.), of oil in 48 cans.
- G_{60} = Lbs. gal. of oil corresponding to API gravity of oil, measured to within 0.1° API.
- M_x = Coefficient for converting volume of oil at x° F. to volume of same weight of oil at 60° F.
- x = Temperature, in °F., of oil passing through the filler.

To get the new basic scale setting, with the machine locked in one position, the fixed scale of the vernier should be moved the distance equivalent to an average T which would be calculated from at least six separate determinations. The scale is to be moved down if the result of the following formula is negative, and up if it is positive:

$$T = \left[V - \frac{(100 - A)\,(1/M_x)}{100} \right] / 0.000436$$

where:

- T = Amount, in terms of vernier reading, that the basic setting of the vernier should be changed to provide the desired amount of average overfill when the temperature of the oil passing through the filler is the same as the indicated vernier setting.
- V = Average volume, in quarts, that the machine delivered to each can.
- A = Allowance — the required % of average overfill.
- M_x = Coefficient for converting volume of oil at x° F. to volume of same weight of oil at 60° F.

0.000436 = Coefficient of expansion for range of oils filled.

Details of the statistical quality control technique as applied to this problem were brought out by Mellon and Beck in their original paper, but are beyond the scope and the purpose of this present review. However, it should be explained that the term "quality" as defined in this technique is simply the amount of variation of statistical figures in a given system. It carries no connotation of good or bad: more variation may sometimes be good. It should not be confused with the non-statistical word "quality." The two are only remotely related.

"Control" is defined as determining the optimum quality levels and then making the measured values in a given system conform with them. The criteria of optimum are almost always predominantly economic if such long run considerations are included as reputation, safety, etc. There is no rational basis for reducing deviations of the quality of a product if the extra cost does not benefit the customer or the producer commensurately. It is often good, sound business to relax the control standards, the authors pointed out.

"The hottest thing in management today" is the way statistical quality control has been described recently, according to Mellon and Beck. Its potential value is discerned only by those who see "quality" in broader terms than products from an assembly or a production line. They point out that the greatest misuse of statistics is in improper definition of the so-called "universe" in question — that is, the system whose properties are being sought by a particular investigation.

By way of illustration, they mention the famous *Literary Digest* magazine's assumption that some telephone books represented the same "universe" as the United States voting population. More recently, another "statistical" study showed that Yale graduates have more children than Vassar graduates, therefore men have more children than women! Less obviously, but fully as logically, false statements are made in almost every issue of the daily newspapers, they said, and they are used as bases for laws in practically every session of our legislative bodies.

A national technical organization in the field — the American Society for Quality Control — was founded only six years ago. It held its Sixth Annual Convention in Syracuse, May 22-24.

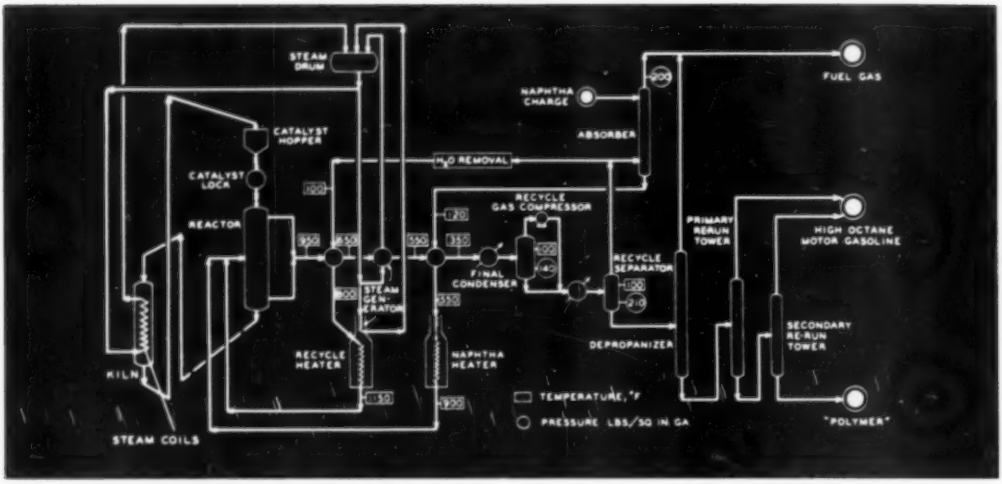


FIG. 1. Diagrammatic flow chart of Thermofor Catalytic Reforming process.

Thermofor Catalytic Reforming

The Thermofor Catalytic Reforming (TCR) process of Socony-Vacuum Oil Co., Inc. is of the regenerative moving bed type employing a single pressure reactor, with no reheat furnaces and with an atmospheric TCC-type kiln. The catalyst is a synthetic chromia-alumina gel bead.

Process and mechanical design of commercial units is described, as presented in the report. Pilot plant data for reforming 10 different types of charge stocks under commercial design conditions is reviewed, from the report. Reforming for aviation gasoline base stocks is reviewed briefly. The economics of TCR reforming is compared with thermal reforming and catalytic polymerization.

This material is condensed from a report by the authors, presented before the 17th Mid-Year Meeting of the API Division of Refining, San Francisco, May 12-16, 1952.

By J. W. PAYNE and L. P. EVANS, Socony-Vacuum Laboratories
and E. V. BERGSTROM and V. O. BOWLES, Socony-Vacuum Oil Co.

IN ANTICIPATION of the trend towards higher octane number requirements for motor gasoline, Socony-Vacuum Oil Co. Inc. for several years carried on experimental work which culminated in the development of the Thermofor Catalytic Reforming process. This work involved both catalyst research and process development, first through various types of bench scale studies and, finally, on a 50-b/d pilot plant scale.

Extensive process design and economic studies based on the pilot plant TCR program demonstrated that the optimum operating conditions are largely independent of feedstock properties. The final result of these studies led to the selection, in the commercial design, of a single reactor, without reheat, which employs gas recycle in the amount of approximately 6 mols of recycle gas per mol of naphtha, with operation at a pressure of about 175 psig and at a space velocity of 0.7. Average reactor temperature may range up to 1000°F. for reforming to an F-1 octane number of 100 upon the addition of 3 ml TEL per gallon.

Flow Plan

A schematic flow diagram for a commercial TCR unit is illustrated in Fig. 1. Starting with the reactor, the effluent therefrom flows through heat exchange, with recycle gas and naphtha, to a final condenser. The condensate and gas are then separated in a receiver which operates approximately at a pressure of 140 psig. and a temperature of 100°F. The gas from this receiver is compressed to approximately 210 psig. by the recycle-gas compressor. The condensate is pumped up to the same pressure, after which both are recontacted and cooled before they flow to the recycle separator. The condensate from the recycle separator is pumped to a depropanizer or to other suitable stabilization facilities.

The net gas production flows to an absorber, and thence to the fuel line. Naphtha charge is pumped over the absorber, in order to obtain the desired recovery of light hydrocarbons from this gas; and it is pumped from the base of this absorber through heat exchange, thence through the naphtha heater which raises the temperature to approximately 900°F. and finally into the reactor.

The recycle gas, which is the main stream to leave the recycle separator, passes first through a dryer, next through heat exchanger with the reactor effluent, and finally through the recycle heater which heats this material to a temperature of approximately 1150° to 1200°F. The hot recycle gas mixes with the heated naphtha just before both enter the reactor.

Catalyst flows downward through

the reactor in a compact moving bed. Inasmuch as the catalyst flow is comparatively small, ranging from approximately 5 to 50 tons per hour for units which have throughputs up to 20,000 b sd, it may be transported from the base of the reactor to the top of the regenerator with bucket elevators or with other suitable lift equipment. The regenerator is a conventional multi-zone type of Thermofor kiln, similar in operating principle to those installed on TCC units. This type of kiln is well-suited to the low catalyst-circulation requirements of the TCR process, and it does not embody any new or unusual design features.

Catalytic Section

The catalytic section of TCR units is very similar in general arrangement to the catalytic section of the smaller-size bucket-elevator type TCC units, a number of which have been built in the 3,000- to 5,000-b/d range. Just as in these TCC units, the TCR catalytic section is arranged with the reactor and kiln side by side. Auxiliaries to the reactor-kiln system include a hot catalyst storage bin for holding the catalyst during a shutdown, a fresh catalyst bin, and an elutriator for removing fines from a continuous catalyst slip stream.

The TCR kiln operates at substantially atmospheric pressure. A kiln for a 15,000-b/d TCR unit would normally be designed to burn about 2000 lb of coke per hour, with a catalyst circulation of approximately 25 tons per hour. Regeneration is accomplished in several burning stages, with cooling between stages. Inasmuch as TCR catalyst burns quite rapidly, the average regeneration temperature is maintained in the range of 800° to 1000°F, which is approximately 200°F. lower than the comparable temperatures in a TCC kiln. Control of burning is accomplished mainly by regulation of the combustion-air temperature to the various zones. Secondary control is provided by regulation of the cooling coils between burning zones. Just as in TCC units, the cooling coils also serve for steam generation.

The reactor for a 15,000-b/d TCR unit is approximately 11 ft. in diameter, and is designed to operate at a pressure of 175 psig. The naphtha and recycle-gas feed enter the center of the reactor and flow upward and downward to suitable vapor-disengaging sections. The two vapor streams which leave the reactor are combined before they enter the heat-exchange system.

The commercial reactor is provided with the same type of pressure-lock system as is used for the introduction of catalyst in the 50-b/d unit. The operations of filling, pressuring, emptying, and depressuring are controlled by a cycle timer which operates on a 10-min cycle. The valves are 8-in. plug cocks which are equipped with stellited plugs and seats with special lubrication grooving; they are of the same design as those used in the 50-b/d unit.

Spent catalyst is purged in the bottom of the reactor, and after it has left the reactor, it is transferred to a bucket elevator. In Fig. 1 this transfer system is purposely shown in diagrammatic form for the reason that alternate designs are under consideration and because no specific information can be given at this time.

Heat Exchange and Recovery

Inasmuch as the heat content of the reactor effluent is large, an efficient heat-exchange system is essential to the economical functioning of the process. Fortunately, the reactor effluent material is very stable, and it is possible to heat-exchange this stream directly without quenching. This insures the maximum availability of high-temperature level heat to the extent that approximately 60% of the total heat removed from the reactor effluent serves to preheat the reactor input materials, and an additional 10% is used to generate steam. In the design of the heat-exchange system, particular attention must be paid to the economics of pressure drop, because any pressure drop in the reactor effluent or in the recycle exchanger must be supplied by the recycle-gas compressor.

Fired Heaters

In order to avoid thermal cracking in the naphtha heater, the outlet temperature is limited to 900°F. maximum, and the furnace is designed for a high heat input rate to the tubes near the outlet in order to reduce time-temperature effects.

Although the recycle gas contains about 1% of pentane and heavier hydrocarbons, it is estimated that no significant cracking of this material will occur at temperatures below 1200°F. Nevertheless, as an extra precaution, the recycle-gas heater is designed to minimize cracking. In addition, this heater is designed for a low pressure drop, viz., 15 psi., in order to maintain compression requirements at a minimum. Inasmuch as the recycle gas enters this heater at a comparatively high temperature (approximately 800°F.), only radiant surface is used.

For heat economy, the convection section of this heater is designed as a steam-generating unit and is tied in with the same steam drum which serves the kiln. This combination of features maintains the amount of surface required for heating the recycle gas to a minimum, and thus makes it possible to achieve a low pressure drop while thermal cracking effects are reduced to a minimum. The total heat absorbed by the recycle gas and naphtha in the heat-exchange system exceeds that absorbed in the furnaces by about 20%.

Compression

The total pressure drop through a TCR system which operates at a pressure of 175 psig. reactor pressure is approximately 70 psi. For this condition, typical pressures at several points in the system are as follows: recycle-gas compressor, 210 psig.; reactor inlet, 185 psig.; reactor outlet, 175 psig.; and recycle-gas compressor suction, 140 psig. Because the recycle gas is circulated in large quantities, and because it has a low molecular weight, this system offers an ideal application for a centrifugal gas compressor. It is proposed, therefore, in plants with a capacity of 2000 b sd or higher, to install a single centrifugal recycle-gas compressor which will be driven by a condensing turbine.

Absorption and Stabilization

The product stabilizer is essentially a depropanizer from which C_4 + reformate is withdrawn as bottoms. Normally the overhead from this unit would flow to fuel gas, although, if desired, some condensate could be recovered therefrom as liquefied petroleum gas.

The absorber operates at a pressure of 200 psig., and it is designed to recover substantially all of the pentane and heavier components and about 90% of the butanes from the "off" gas. Although this recovery arrangement necessitates the recycling of a small amount of C_4 + material back through the reaction system, it has been established that this design is more economical than an independent absorption and stripping system.

Polymer Removal

On some light stocks, the stabilizer bottoms can be used for motor-gasoline blending without further processing other than caustic washing. However, when naphthas of 400°F. end point, or higher, are charged, or when naphthas which contain substantial percentages of cracked materials are charged, it is anticipated that the gasoline will contain about 1% of polymer which should be separated.

To accomplish this separation with a minimum loss of gasoline, it is proposed to provide a two-stage gasoline rerunning system. The first stage will flash overhead a substantial percentage of gasoline which contains no polymer, the second stage will make a sharp separation between polymer and gasoline of the desired end point.

In the event it becomes necessary

Table 1—Properties of Charge Stocks Used in 50 b d TCR Reforming Runs

	Tibu Petrolea (Colombia) Paraffinic Naphtha	Mixed Texas Naphthas	Dependanized West Texas Naphtha	California (Wilmington) Naphtha	Naphtha Blend from Wilmington Crude
Gravity, °API	54.6	56.5	57.6	55.9	46.2
Sulfur, % by wt	0.0	0.0	1.7	1.0	0.7
Nitrogen, % by wt	0.0	0.0	0.1	0.0	0.0
Aromatics, % by vol	12.5	24.0	13.5	33.0	14.7
Olefins, % by vol	0.0	0.0	0.0	0.0	0.0
Copper, % by wt	0.002	0.004	0.17	0.13	0.05
F-1 Octane Numbers					
Without TEL addition	53.0	69.8	61.2	69.0	63.2
With 3 ml TEL per gal	80.0	89.4	78.2	77.5	73.1
ASTM Distillation, °F					
Initial boiling point	127	124	160	166	225
10% point	166	156	190	201	266
50% point	204	200	212	228	314
90% point	247	248	253	340	384
End point	290	284	295	471	400

[1] Blend of 58.3 Wilmington naphtha and 40.5 mixed naphtha from Wilmington Coast crude.

Table 2—Pilot Plant Yields on TCR Reforming of Five Stocks Shown in Table 1

	Tibu Petrolea Naphtha	Mixed Texas Naphthas	West Texas Naphtha	California straight run Naphtha	California straight run and Coker Blend
Reforming conditions					
Pressure, psig	175	175	175	175	175
Mole ratio, recycle gas/moles of naphtha (per mole per minute of catalyst in the reactor)	0.44	0.72	0.70	0.40	0.80
Average reactor temperature, °F	900	902	901	902	900
Recycle gas to naphtha mol ratio	6.3	9.4	9.4	5.9	9.9
Hydrogen in recycle gas, mol %	91	90	87	83	82
Reactor gas effluent, mol °F	1,000	1,000	1,000	1,000	1,000
Separator pressure, psig °F	1,000	1,000	1,000	1,000	1,000
Yields based on Charge					
100-lb RVP reformate, % by vol	92.0	87.2	90.1	83.4	84.0
Butanes, % by vol	3.0	0.6	0.4	2.2	6.1
Pentanes, % by vol	0.0	10.6	10.2	12.2	8.2
Total C5+, % by vol	9.6	7.9	8.6	8.8	8.6
Total C4's, % by vol	3.3	7.3	3.9	6.5	8.5
Total C3's, % by vol	1.5	1.1	1.0	1.6	1.0
Hydrogen, % by wt	1.1	1.1	1.2	1.1	1.1
C1 and lighter, % by wt	1.2	1.2	1.2	1.3	1.4
H2 production, cu ft per bbl	328	411	381	430	247
Properties of 100-lb RVP reformate					
Gravity, °API	52.2	53.1	53.6	51.1	48.6
Research octane No.	93.5	94.8	94.1	97.4	95.9
Aromatics, % by vol	44.0	54.8	51.6	45.5	53.1
Olefins, % by wt	0.0[2]		0.0[2]	0.0[2]	0.0[2]
F-1 Octane No. of 100-lb RVP reformate					
Without TEL addition	74.1	87.0	84.8	94.3	89.3
With 3 ml TEL per gal	94.1	95.5	96.0	101.4	97.0

to produce aviation blending stocks, this two-tower arrangement will be satisfactory for the preparation of a sharply fractionated high-quality aromatic aviation blending stock. Reboiler heat for these operations may be supplied with fired reboilers or, alternatively, with a recirculating hot-oil system.

Water Removal

The 50-b d pilot-plant studies emphasized the need for dehydrating the recycle-gas stream. An investigation of various drying methods showed that satisfactory drying can be obtained by means of refrigeration, solid desiccant, or liquid desiccant. Although solid desiccant is the most effective for the reduction of moisture content to extremely low levels, the liquid-desiccant scheme is adequate for this application.

The catalyst finally selected for development especially for the TCR process is a synthetic chromia-alumina gel of a type having the following desirable characteristics:

1. It has a "high octane-number ceiling"; i.e., it permits reforming to high anti-knock quality (F-1 100 octane number or higher, upon the addition of 3 ml TEL per gal), with good results.

2. It operates with low hydrogen partial pressure.

3. It can be readily regenerated by burning off the coke deposits. Thus wide latitude is provided for reforming all types of stocks, particularly the high coke-forming, thermally cracked stocks, as well as the broad boiling range straight-run stocks.

4. It promotes excellent desulfurization, and the sulfur is eliminated mainly as hydrogen sulfide in the reforming gas, thus avoiding a potential air-pollution program.

5. Finally, the catalyst is in bead form and possesses the high physical strength and ruggedness of the TCC bead cracking catalyst.

Pilot Plant Charge Stocks

Ten different types of stocks have been processed in the 50-bbl. TCR pilot plant and the products evaluated. One of these stocks, a 200-380 F. end point straight-run gasoline from Tibu-Petrolea (Colombia) crude was available in large quantities and was used, therefore, for "shakedown" operations and for extensive study of process variables.

The other stocks, obtained from several other refineries in tankcar quantities, represent potential charge stocks for TCR units being considered at those plants.

Table 1 summarizes properties of five of these stocks and Table 2 gives the actual pilot plant data for reforming them under commercial design conditions to octane number levels in the F-1 range of 96 to 100 upon the addition of 3 ml TEL per gal. In the case of the Wilmington blend, excellent desulfurization and anti-knock quality improvement were obtained, with a high product yield. Because of the scale of pilot plant operations, adequate quantities of products could be prepared for extensive performance tests. The pilot plant gasolines have a moderate olefin content, and they require only a small amount of inhibitor—up to 3 lb. per 1000 bbls. for acceptable stability. Results of engine tests have been reported which show that finished TCR gasolines have an acceptable engine-cleanliness rating and give road anti-knock performance consistent with laboratory ratings of other gasolines in the same range.

Producing Avgas Base Stocks

While the foregoing data deals with reforming for motor gasoline production, the process is equally adaptable for the production of highly aromatic aviation gasoline base stocks. Preferred charge stocks for such operation are the straight-run gasoline fractions which boil in the 200-300 F. range, particularly those which contain substantial amounts of naphthenes from which light aromatics are formed. Reforming conditions required for processing such stocks for aviation gasoline are more severe than those necessary for motor gasoline operations. In a unit designed for motor gasoline reforming, the added severity can be obtained by operating at the maximum temperature and at a somewhat reduced throughput rate, other conditions remaining constant.

Several reforming runs of this type were made on representative stocks in the 50-bbl. pilot plant, and data on West Texas and Wilmington naphthas are given in Table 3. The West Texas naphtha yielded 42% by volume of an aviation blending stock which, when pressured with isopentane to a Reid vapor pressure of 7 lb., had an F-3 blending octane number of 99.5 and an F-4 index number of 160 upon addition of 4.6 ml TEL per gallon. The California naphtha yielded 32% of aviation base stock which, with 4.6 ml TEL, had an F-3 blending octane number of 98 and an F-4 index number of 177. Aviation reforming operations can be

used equally well to produce reformates rich in specific aromatics such as benzene, toluene or xylenes.

Economics of TCR Process

The economics of TCR operations is presented by comparing catalytic reforming vs. thermal reforming and the additional required catalytic polymerization, in a typical modern refinery processing 30,000 b d of Mid-Continent pipeline crude. It is assumed that existing distillation, catalytic cracking, delayed coking and catalytic polymerization facilities are adequate for producing present gasoline octane number requirements, but that reforming is necessary to provide an F-1 92 pool octane to provide for meeting future competition. With this pool octane number it would be possible to maintain a balance between production of 95+ octane premium grade and lower octane regular grade motor gasoline.

The catalytic reforming and gasoline blending calculations are based on the use of TCR unit to reform 5600 b sd of 260-410 F boiling range (41.4 F-1 unleaded; 64.2 F-1 with 3 ml TEL) virgin naphtha to produce a reformate with an F-1 98 octane upon adding 3 ml TEL. Reformer charge stock is prepared on the crude distillation unit, while a 280 F. end point straight-run gasoline with an F-1 octane of 84.6 with a 3 ml TEL is taken overhead.

For comparison, it was determined that a 5700 b sd thermal reforming unit would be required for the same target octane number. In this case a 5500 b sd naphtha refractionator would be required to provide a 200-380 F. boiling range naphtha charge for thermal reforming, leaving a 225 F. end point light straight-run gasoline for blending. It is advantageous in this case to expand an existing 1000 b sd catalytic polymerization unit to 1300 b sd (catalytic polymer gasoline) to utilize butylenes and propylenes produced from expanded thermal reforming.

The cost of the projected TCR facilities is estimated to be approximately $3,100,000, including a 3600 b sd TCR unit, paid up royalty therefor and all off-site requirements. The cost of the equipment for the thermal reforming case is estimated at $2,060,000, including a new 5700 b sd thermal reforming unit, naphtha refractionator, additional catalytic polymerization capacity and paid up royalty and off-site equipment. The evaluations, shown in Table 4, indicate net earnings for TCR reforming, over those for thermal reforming and catalytic polymerization, of approximately $2000 per day. On the basis of an incremental investment of $1,040,000 a payout of 1.4 years is indicated. To the extent that existing refinery facilities could be converted into the thermal reforming equipment, the investment for thermal reforming might be decreased. Then the differential investment would be higher and the payout time longer. Conclusions from the two types of operations compared in Table 4 are:

1—Gasoline yield is increased about 4% for the same octane number with Thermofor Catalytic Reforming. This additional gasoline is produced at the expense of heavy fuel, fuel gas and volumetric loss.

2—Under some operating conditions fuel gas production might be excessive with intensive thermal reforming. This uneconomic situation could be avoided with catalytic reforming which, in effect, converts fuel gas and loss to high-quality gasoline.

3—Total fuel requirements, including steam and water, are approximately 50% higher for thermal reforming than for TCR; power requirements are about 40% higher.

4—Chemical and catalyst losses are almost identical for the two processes. Incremental catalytic polymerization with thermal reforming has a moderate catalyst requirement which offsets TCR catalyst cost.

Table 3—TCR Reforming for Aviation-Gasoline Blending

	West Texas straight-run Naphtha	California straight-run Naphtha
Gravity, ° API	64.1	58.7
Boiling range, ° F	212 to 295	262 to 352
F-1 octane number, unleaded	40	48
Reforming Conditions		
Pressure, psig	175	175
Space velocity, volumes of naphtha per hour per volume of catalyst in the reactor	0.35	0.35
Average reactor temperature, ° F	975	1,025
Time-on-oil, hrs.	12	12
Yields		
Pre-aviation cut (C5 to 200° F end point), % by vol.	32.2	29.7
Aviation-base stock (200 to 325° F), % by vol.	62.0	62.1
Post-aviation cut (325° F end point gum), % by vol.	3.0	4.0
C4 and lighter, % by wt.	10.0	24.8
Coke, % by weight	0.4	2.0
7-lb RVP Aviation Stock		
Yield, % by volume of charge	61.0	48.4
Aviation blending octane number (F-1) with 4.6 ml. TEL per gal.	98.5	98
Supercharge index number (F-1 with 4.6 ml. TEL per gal.)	100	122

[1] Pressured with superfuel.

Table 4—Economics for TCR Reforming vs. Thermal Reforming for 30,000 b d Mid-Continent Refinery

Production Value	Price $ bbl.	TCR b d	Thermal Reforming b d	Incremental b d	Incremental $ day
92 Research gasoline	3.04	16,997	15,980	617	2,110
No. 6 fuel oil—sales	1.75	783	1,191	(368)	(644)
Refinery fuel	1.75	2,240	2,947	(141)	(247)
Loss		318	426	(108)	
					2,219

Costs—Incremental	TCR $ day	Thermal Reforming $ day	Incremental $ day
TEL (total gasoline)	2,528	2,397	131
Labor and burden	280	180	80
Maintenance and supv.	160	267	193
Fuel (includes steam and water)	466	713	(247)
Power	71	199	(128)
Chemical and catalyst	56	54	2
Laboratory	13	10	3
Supplies and miscellaneous	5	2	3
Taxes and insurance	78	51	27
			100
Earnings, TCR over thermal reforming and catalytic polymerization			2,119
Investment, incremental			$1,040,000
Payout, years			1.4

NOTE: Figures in parentheses are negative.

SMALL SAMPLES of gasoline can be knock-tested in this standard equipment with only minor carburetor modifications

Here's How to Run Octane Ratings with 20-40 ml. Samples

By R. F. GALLOWAY, Technical Department
Refining Division, Magnolia Petroleum Co.
Beaumont, Texas

THE standard ASTM methods for octane number determination, D 357 and D 908, have been used for many years. These methods were designed primarily for plant control and automotive research work where fuel supplies were ample. The quantity of sample required by these methods varies from 250 to 500 ml., depending upon fuel sensitivity and engine condition.

In recent years the demand for high octane number fuels has led to a considerable amount of research work on bench scale and pilot plant equipment. Under such conditions only small amounts of gasoline can be prepared. The complete testing of the resulting products, including octane numbers, has left the investigator with no alternative but to estimate the octane numbers from their blending values or to multiply the individual runs for securing the desired quantities of products. The first method does not give a true octane number of the distillate while the second method is expensive and time consuming.

Several micro methods for octane number determinations have now been proposed. These include the modification of the standard carburetor system to include the use of a small commercial carburetor to reduce float chamber "hold-up" and the use of a multiple buretting system whereby the fuel is fed directly to the horizontal carburetor jet and allowed to pass through the point of maximum knock as it is consumed. Either method requires the use of a special carburetor jet and deviates considerably from the standard CFR carburetor.

In order to avoid these complications, a micro method for octane number determination has been developed in the Magnolia Laboratories which uses the standard carburetor system with only minor modifications. The only real change from the standard procedure is the way in which carburetor fuel levels are controlled and maintained. The exact minimum amount of fuel required for each octane number determination by this method, as well as by any other micro method, depends upon the sensitivity of the fuel, available information on the sample, and the experience of the operator. Octane numbers of high accuracy can be obtained on samples of fuel as small as 20 to 40 ml.

Fig. 1 shows that the carburetor sight glass has been slightly shortened and a filler plug has been inserted in the bottom of the sight glass holder. This plug serves to take up space and reduce the volume necessary to hold the liquid level at the usual 1.2 to 1.4 markings required to obtain maximum knock. The input hole at the bottom of the sight glass holder is plugged, making the sight glass and holder independent of the carburetor bowl. The vent hole in the sight glass hold down cap has been enlarged to approximately $\frac{1}{2}$" to accommodate the hand filler device.

The hand filler device is a tubular vial with a glass tubing neck. Any similar receptacle would suffice. A $1\frac{1}{2}$-in. section of $\frac{1}{4}$-in. tygon or neoprene tubing is attached to the glass tubing neck of the vial. A $3\frac{1}{2}$-in. section of $\frac{1}{4}$-in. glass tubing angled at one end is attached to the other end of the tygon tubing. These dimensions are not critical and may be changed if desired.

Fig. 2 shows the modified carburetor equipment installed, with an operator using the hand filler device to fill the float gage glass with naphtha.

The necessary equipment for modification of the carburetor are shown in detail in Fig. 3, and in an exploded view in Fig. 4.

The Phillips Detonation Meter is employed for all determinations. If the model 501A is used no modification is necessary, but if the model 501 is used certain changes must be made. This involves the installation of a 0 to 10 megohm variable resistance in series with the 1.2 megohm fixed resistance, marked R-29 in the wiring diagram. With the selector switch in the "short time" position, the variable resistance switch is adjusted to give the desired knock-meter swing.

The octane number of the test fuel is estimated as closely as possible. This requires full information on the sample such as type, approximate boiling range, lead content, etc. The CFR cylinder clamping device is adjusted so that compression ratio

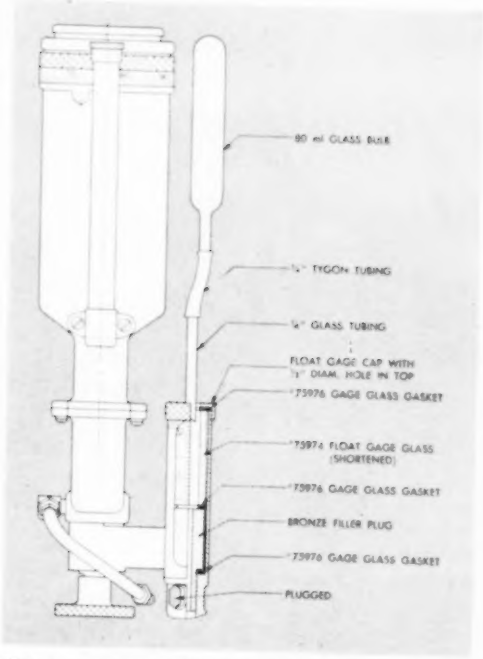


FIG. 1—MODIFIED CARBURETOR required for micro method for octane number determination

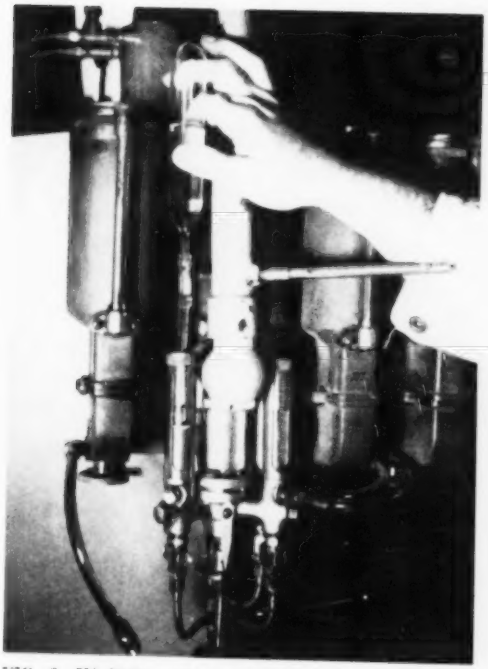


FIG. 2—IN USE, with operator filling float gage glass from hand filler device

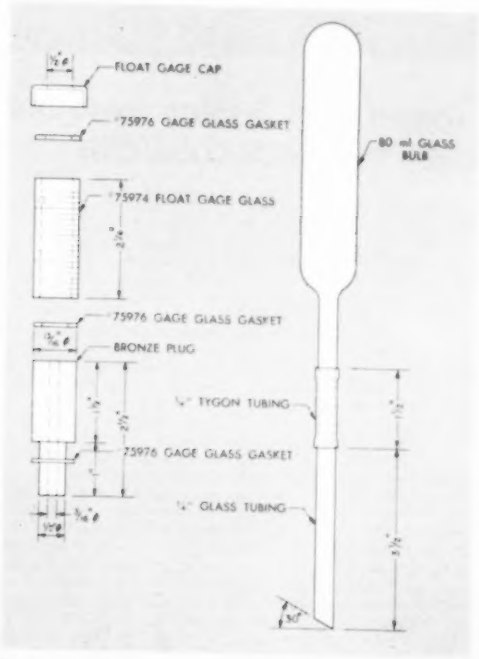


FIG. 3—DETAILS of equipment needed to modify standard carburetor system

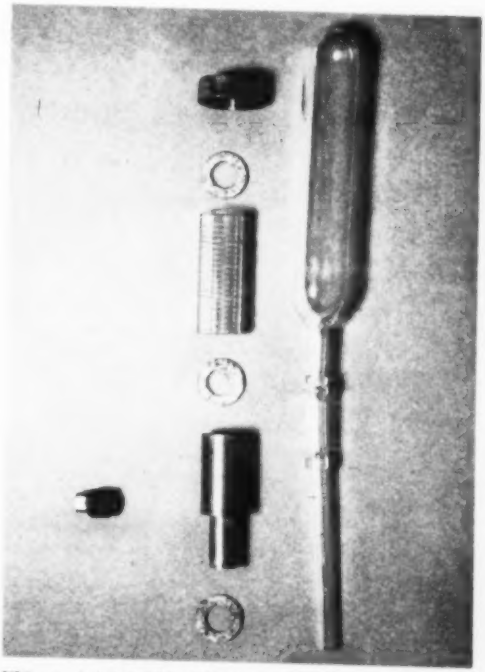


FIG. 4—EXPLODED VIEW of attachments shown in detail sketch at left

change might be made without loosening the clamp. This change can usually be made with standard clamp setting. The engine is set to the compression ratio of the estimated octane number and reference fuel blends are established. A spread of 15 to 20 knockmeter divisions per octane number is considered necessary.

After reference fuel blends are established the carburetor is switched to the test sample and the detonation meter is switched to the "short time" position. The test fuel is fed to the sight glass from the glass vial and the level is held at the height usually required to obtain the correct air-fuel ratio for maximum knock for that bowl. After engine equilibrium has been determined, the level in the sight glass is changed by raising or lowering the vial by hand to obtain maximum knock. If the compression ratio must be altered, the crank is turned with one hand while holding the vial with the other. When the correct compression ratio is reached the sample is carried through the air-fuel ratio range and reference fuel blends are again established.

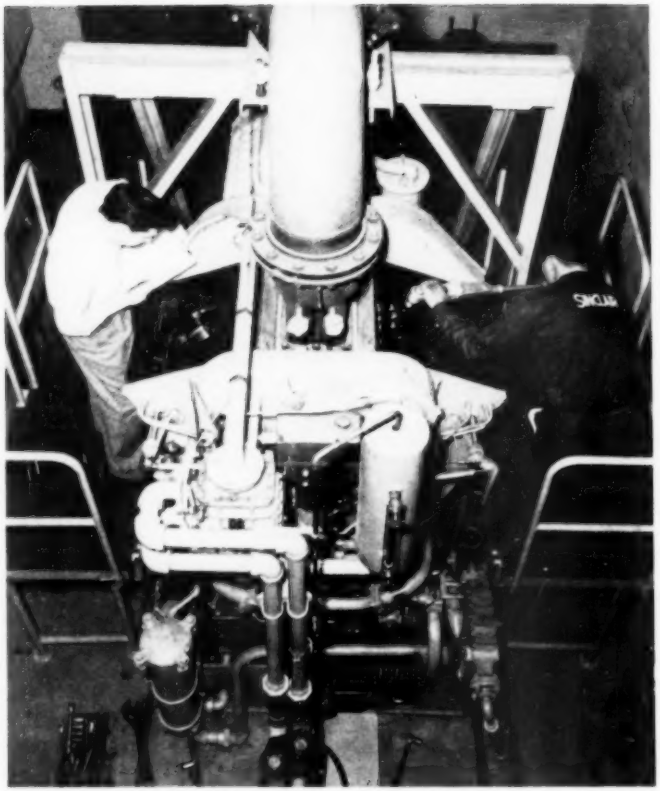
Table 1 compares the results obtained by the use of the micro and macro methods and shows that the new micro method is applicable for determination of octane numbers by both Research and Motor methods. The average accuracy of the micro method has been well within that expected of the standard methods for samples having a normal boiling range.

On either method, some samples, particularly leaded straight run distillates, require considerable time to stabilize the engine. For economizing the quantity of sample employed, it is necessary, after reference fuel blends have been established, to replace the reference fuel in one bowl of the carburetor with a fuel of a type similar to the test sample and allow the engine to become stabilized on this fuel before switching to the test sample.

Approximately 800 octane numbers have been determined by this micro method since it was developed almost two years ago.

Table 1—Comparison of Octane Ratings Determined by Micro and Macro Methods

Fuel	Octane Numbers — Motor D357 Micro	Motor D908 Micro	Research D908 Micro
Catalytic Gasoline			98.8
Catalytic Gasoline			96.6
Platform Gasoline			92.8
80% Run Gasoline			74.6
Premium Gasoline			93.2
Regular Gasoline			83.0
Catalytic Naphtha			83.2
Base Gasoline	83.3	83.3	
Premium Gasoline	92.4	92.7	
Regular Gasoline	78.8	78.9	
80% Run Gasoline	74.9	75.1	



Special RR Diesel Test Engine Installed In Sinclair Labs to Check Lube Oils

THE first railroad Diesel test engine to be installed in an oil company laboratory is now in operation at the Sinclair Research Laboratories in Harvey, Ill. At present it is being used for testing and development of lubricating oils for heavy duty Diesel service.

Designed by the Electromotive Division of General Motors Corp., the special engine is the result of more than six years of experimentation and refinement by General Motors. It has only two cylinders, but the component parts, in so far as possible, are the same size and shape as those in large 16-cylinder commercial engines used on railroads throughout the country.

It is known as EMD 2-567B Diesel, and has a 2-cylinder "V" type 2-stroke cycle engine with an 8½-in. bore, 10-in. strike and 567 cu. in. displacement. At rated speed and load of 800 rpm-188 brake horsepower, fuel consumption is approximately 11½ gals. an hour. Lubricating oil capacity of the crankshaft is 40 gals., and water jacket capacity is 22 gals. With the exception of a shorter crankshaft and camshaft, more counterweights to eliminate vibration, one blower instead of two, and one oil filter cartridge instead of the usual four found on a locomotive, the engine uses standard locomotive parts.

In the lubricating oil tests operating periods will range from 300 to 500 hrs. at 800 rpm brake horsepower, with elevated oil and water temperatures. This is equal to the severest condition encountered in railway service. It will be inspected at 100-hr. intervals, at which time samples of crankcase oil will be removed and sent to the laboratory for analysis and spectrographic examination. The results thus obtained will be used as an indication of oil stability and engine condition. At the conclusion of the test period the engine will be disassembled and all parts inspected, rated and measured for wear.

Jacket water rust inhibitors will be tested at the same time oil tests are in progress.

50 YEARS OF

Petroleum Chromatography

Part 2—Technological Era

By HERBERT WEIL
London, England

Technological Chromatography

When the equipment now customarily used in chromatographic engineering is examined, it becomes apparent that very little change has taken place since Day. Although refinements in details have been introduced, the batch character of chromatographic treatment has been preserved. Industrial chromatographic separators are one-piece, all-purpose columns. Fractionation proper and subsequent operations are carried out one after the other in the same device, irrespective of the type of chromatography employed.

Two different methods of isolation have already been referred to above. The first consists of more or less primitive evacuation of the whole body of the secondary material comprising the chromatogram from the separation tube, and of subsequently cutting up the columnar material into the supposed zones.

The second isolation process makes use of flowing chromatography. The filtrate is collected zone-wise, and many means have been devised for the determination of the individual effluent fractions of the flowing chromatogram discharged from the tube.

It is obvious that both types of isolation entail the interruption of separation proper. In the first place, refilling and readjustment of the column is a delicate, time-consuming procedure. Isolation of the zones of the chromatogram by washing them out from the tube has many disadvantages, which are specific for this method. Not only is the process cumbersome, but any achieved concentration may be lost during the passage of the chromatogram down the tube, and at the collection of the effluent fractions. Reconditioning of the secondary material after isolation is not an easy task. And last, but not least, the ratio of the solvents needed for evacuation may be very untavorable in comparison with the treated batch of the stock, a disadvantage of considerable significance in industrial chromatography. To date only isolation by means of flowing chromatography has been used in large scale chromatographic separations, and our discussion can therefore be restricted to this particular isolation procedure.

Two of the disadvantages of the method must be singled out:

1.—The accentuation of the batch character of chromatographic treatment, and more specifically the tremendous loss of time for each part-operation.

2.—The fact that one-piece columns used for all operation-steps of which a chromatographic operation consists is always a compromise between the exigencies of those part-operations which may require very different conditions.

By the use of this type equipment, chromatography often is not eligible for a particular commercial application, and is definitely restricted for separations in which minor quantities of nearly related and valuable substances have to be separated one from the other. An appearance of continuity may be obtained by recycling the fractions of a discharged flowing chromatogram in identical columns, which may be arranged in batteries or in cascade. Finished product may—when no breakdown of the interconnected system occurs—thus be obtained continuously, but the shortcoming of this type of equipment becomes only more perceptible when the process is analyzed. Each individual column remains an all-purpose device, in which all operation-steps are successively affected, and the principle is not changed by carrying out the individual part-operations at different times in the different columns of which the system consists. Such equipment means an accumulative rise in cost and, at least as a rule, no cheapening of the process.

Before genuine embodiments of chromatographic equipment which have been revealed since 1947 are surveyed, reference must be made to two new dynamic selective adsorption processes. Both processes have been evolved for the collection of particular hydrocarbons or hydrocarbon fractions from mixtures, and have intensified the interest of the petroleum industry in chromatography; they may be considered as a preliminary to genuine chromatographic production. These processes are the "Hypersorption" process and the "Arosorb" process. Both operations are typical adsorptive filtration processes, in which only two products (filtrate and adsorbate) are obtained in one and the same operation. Otherwise the differences in the engineering set-up are fundamental.

The "Hypersorption" process provides precise concentration-separation of light gases, such as ethylene, from natural and industrial sources.[1] This process is utilized on a fully commercial scale. It is a continuous operation, an arrangement made possible by the use of a moving bed of activated carbon.

The "Arosorb" process is intended to be used commercially for the purification of reformates, such as benzene, toluene and other aromatics occurring in a mixed liquid stream. While the Hypersorption process has been designed for the recovery of

Meet the Author

Herbert Weil was born at Castle Wildthurn in Bavaria. He attended three German universities, receiving his Ph.D. at Heidelberg University. Subsequently he was manager and a partner of an oil firm for many years. He has published a great many articles and a few books on various technical subjects. During the last decade he has concentrated on the present subject—chromatography, and has written over 20 articles on it. Some patents on industrial chromatography have been granted to him jointly with C. G. Lynam, late chief engineer of the Iraq Petroleum Co.

Dr. Weil is now a British subject, and resides in London. Two of his sons are U. S. citizens and studying at the University of Chicago.

small quantities, the Arrosorb process has been evolved for the fixation and liberation of a major fraction of hydrocarbons in a fixed bed of silica gel. The process is based on the well known affinity of silica gel for aromatics and the repelling of saturates. The adsorption battery consists of six interconnected cases, each of them 10 ft. in diameter and 20 ft. high, housing a total of 500,000 lbs. of gel. Different part-operations take place simultaneously in the cases, thus giving an impression of continuity. Actually, as far as the individual cases are concerned the operation is a typical batch-type operation. All part-operations such as adsorption of aromatics, elimination of occluded saturates, liberation of the aromatics from the adsorbent, and reconditioning of the secondary material are accomplished in each case in rotation.

Adsorption proper is employed only in a rather restricted manner. Heavier molecular weight aromatics are eliminated from the stock by a pretreatment, while separation of benzene and toluene one from the other, removal of olefins, and fractionation of a xylene aggregate are subsequently achieved by non-adsorption processes. As various types of filtrates are obtained in different operation-steps, a flowing pseudo-chromatogram is achieved, but no spatial fractionation happens in one and the same part-operation. A genuine chromatographic arrangement can be visualized, replacing adsorptive filtration and some distillation treatments by a true chromatographic system. The Arrosorb process seems, however, to be the first use of silica gel adsorption for commercial fractionation of major hydrocarbon portions. For details the relevant paper published by Guthrie should be looked up.[56]

Silica gel has been used commercially in the petroleum industry in the past for general refining purposes such as bleaching of petroleum and petroleum products, and for the removal of sulfur. E. B. Miller discussed particulars of silica gel gas-adsorption and of silica gel refining equipment back in 1924.[57] Commercial production of light oil by silica gel for motor fuel purposes was described in 1928.[58] The purpose of a silica gel treating plant built at that time at Rochester, N. Y. with a capacity of 1,000 gal. of light oil was to remove gum-forming and unstable compounds from light oil so that on a subsequent distillation a yield of water-white gasoline could be obtained.

In Miller's scheme powdered silica gel was circulated through a series of three adsorbers counter-current to the gas or liquid to be purified. From the last adsorber the gel passed into a multiple hearth muffle-heated actifier, where the materials were recovered and the gel prepared for reuse. The reactivated material was returned directly to the first adsorber, making the process continuous. Completely desulfurized gasoline or kerosine was claimed to be prepared by this process. Miller's silica gel adsorption plant was characterized by continuous circulation of the adsorbent. Continuity was obtained only with repeated use of the gel, and did not mean continuity of each part-operation.

Suggestions on how fractionations of hydrocarbon mixtures and the recovery of desired fractions can be more expediently and economically achieved than with adsorptive filtration processes are put forward below, but some genuine chromatographic large scale arrangements and a few semi-industrial chromatographic systems in which traditional chromatographic apparatus is used have still to be surveyed before a new type of chromatographic equipment can be described.

Four novel embodiments of genuine chromatographic engineering which dealt with the problem of continuity of operation in the traditional way became known in 1947:

1.—A pilot plant constructed for the resolution of fission-aggregates, and the preparation of components thereof, especially individual rare earths of high purity, was described by scientists connected with the Plutonium Project.[59] Separation is accomplished in a battery of 24 columns, each 8 ft. high, and filled with an artificial resin ion-exchanger. Fractionation is effected by a special differential desorption method, called complexing differential elution. Isolation is carried out from the one-piece, all-purpose columns by flowing chromatography. The batch character of the chromatographic system does not comply with economic considerations. As rather pure products are prepared in considerable amounts, however, the purpose of the chromatographic arrangements is achieved. A critical discussion of the outlay of this plant can be found elsewhere.[60] It may be said that the Plutonium plant is much more efficient than previous equipment built for the separation of isotopes. The columns used by Taylor and Urey[61] for the separation of the isotopes of light elements measured 100 ft. in height and had a very small diameter. Columns employed by Russel and Pearce[62] were 50 ft. high. Columns of such tallness and small diameter were then required especially by reason of the insufficient fractionation power of the secondary materials, but also for other deficiencies of the chromatographic set-up.

2.—Mair, Gaboriault and Rossini demonstrated the efficiency of the chromatographic method by the isolation of closely related hydrocarbons in connection with API Research Project 6.[63] They designed a battery of stainless steel columns (16 in. high and of 1.9 cm. inside diameter), filled with silica gel and provided with delicate control devices. A flowing chromatogram is formed within the separation section of a column, from which effluent fractions are separately collected, and cyclic treatment takes place in each column. Two applications may be mentioned: (1) Isomers were chromatographically separated, and (2) a wide boiling gasoline, kerosine or gas oil fraction of natural petroleum was resolved into (a) a portion containing the paraffin and naphthene components, (b) a portion consisting of the bulk of the mononuclear aromatics, (c) a portion comprising the total of the dinuclear aromatics contaminated with a small quantity of mononuclear aromatics, and (d) small intermediates between portions *a* and *b*, and *b* and *c*. The performance of this National Bureau of Standards equipment shows what chromatography can do under favorable circumstances, but engineering methods and operations which are very efficient in the laboratory may become prohibitive in commercial production, where the exigencies of expediency and economy are the compass of the operation.

3.—The works of Valley Vitamins, Inc., McAllen, Texas, are the only known commercial chromatographic operation which seems to have been established to date. Shearon and Gee[64] have described this plant, which produces carotene and chlorophyll, and some by-products. The chromatographic engineering arrangements are true to classical type. The different operation-steps are carried out in one-piece, all-purpose columns, and isolation is accomplished by downward flowing chromatograms. Partial recycling of filtrates ensures increased purity. Altogether, no genuine continuity of operation is striven after, and all the customary shortcomings of traditional chromatographic batch treatment are present. Such a system can only be a paying proposition when the vitamin price is particularly high; the plant had to be closed down with the slump in the vitamin market.

4.—British patent specification No. 585,224[65] was not concerned with the fundamental problem of chromatographic engineering, that is, elimination of the deleterious consequences of the batch character of the chromatographic method. It claimed the superiority of radial flow compared with vertical flow in industrial chromatographic apparatus.

Radial flow has been well known for adsorptive filtration, e.g., in oil-purifiers, but the construction of such devices excluded spatial separation and formation of a chromatogram. M. Rakusin, however, apparently constructed an apparatus somehow related to modern chromatographic radial equipment as early as 1914.[66]

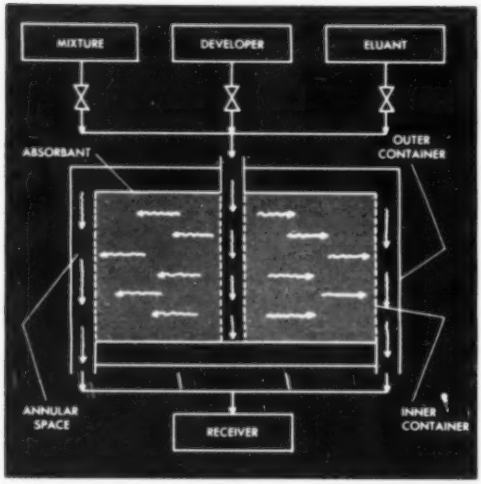


FIG. 1. Schematic representation of the first type of a stationary radial adsorption separator (2 annular concentration zones; isolation by flowing chromatography)

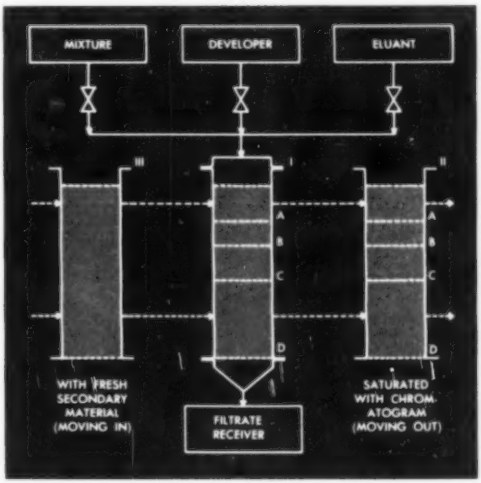


FIG. 2. Schematic representation of a combination column arrangement. Column I is in separation position. Column II is saturated with chromatogram (zones A, B, C and D) and being moved out to a central recovery plant. Column III is filled with fresh secondary materials and is being moved in from the central recovery plant

He passed a hydrocarbon mixture through a disc consisting of finely divided adsorbent, and promoted the flow by centrifuging. Details of his arrangement are not known, however, and it is not certain whether Rakusin's apparatus could be used for genuine chromatographic separations or only for adsorptive filtration.

The radial chromatographic separator, as revealed in British Patent 585,224, ensured formation of a chromatogram, consisting of annular concentric zones in disc-like secondary material, the zones being arranged in a manner identical to the bands of a corresponding column-chromatogram. Horizontal flow takes place from or to a tubular central space through the secondary material present in a perforated coaxially arranged inner container to or from an annular space formed by the outer wall of said inner container and the inside of an outer container, into which the inner container is fitted. Two types of radial separators were described in the patent: (1) a rigid stationary type, and (2) a rotating separator (chromatofuge). A schematic illustration of the principle of this radial chromatographic prototype is shown in Fig. 1.

As a rule, isolation was proposed to be carried out by means of flowing chromatography, and the problem of continuity of operation was completely overlooked. No provision was made to eliminate difficulties arising from gravitational sloping, by which the chromatograms produced were distorted, or from uneven distribution of influent liquid into the secondary material. These difficulties were eliminated in later models.

Specific disturbances were encountered with high-speed chromatofuges, including displacement of the secondary material, caking, insufficient contact between primary and secondary material, and foaming. It was somehow unfortunate that these first rather primitive radial chromatofuges found special interest[5] and were even proposed for commercial fractionation of hydrocarbon mixtures.[6]

Radial flow, however, in itself offers advantages which cannot be equaled by vertical flow in chromatographic technology, even when new types of columns are employed. To sum up some of these advantages:

1—Throughput can be increased through the same amount of secondary material in a column within a time unit.

2—Floor space requirements are reduced.

3—Rotation can possibly be used as a flow promoting agent, and as a means for even distribution of the secondary material when packing and readjusting it.

4—The opportunity exists for using inwards and outwards flow, resulting in different width of the annular concentration areas, a phenomenon of special usefulness when utilized in conjunction with a mechanical isolation system described below.

5—Direct access can be had to all concentration zones.

British Patent 635,271 subsequently supplemented the earlier patent and extended the application of radial chromatographic separators to other types of chromatography such as differential partition.[7]

Radial flow as such has nothing whatsoever to offer for an alleviation of the batch character of chromatography. This problem was attacked by British Patent 611,080,[8] which disclosed "Neo-Day" mechanical methods for the isolation of the zones of a chromatogram. This patent relates to columns as well as to radial chromatographic apparatus. It has already been noted above that Day removed saturated fuller's earth containing the chromatogram bodily from the tube, and then sectioned the adsorbent column into portions supposed to correspond to the zones of the chromatogram. Day's isolation method may be called "primitive" mechanical isolation, a method also employed by Tswett.

The new "automatic" mechanical isolation operation is not carried out by hand, but effected by mechanical means, and automatically at fixed intervals. This procedure becomes possible by the use of combination-separators. Individual concentration zones of a chromatogram are led into corresponding sections of the separator, neglecting other possibilities of automatic mechanical isolation. A spatial domiciliation of the zones of a chro-

tograms can, however, only be achieved by a fairly exact predetermination of the positions of the concentration zones of a chromatogram and by standardization of the operation.

Standardization has now become much easier. Tiselius[55] pointed out in the general introduction to the discussion of the International Congress on Chromatography in 1947 that homogeneous secondary materials are now available for many chromatographic applications. In addition, methods are feasible for reducing flow-disturbances, especially in radial chromatography, and methods have been evolved for arranging the zones of a chromatogram as desired. Finally, many new methods have been developed for the detection of concentration zones in the secondary material while present in the separator, and the use of these methods is much facilitated by the accessibility of all zones in radial chromatography. Reference will be made here only to the registration of zonal radioactivity due to tracers by counters or autoradiochromatographic methods.[56]

Large scale chromatographic fractionation of big quantities of a homogeneous material appears especially promising in commercial applications but the essential reduction of operating costs makes chromatography also eligible for the resolution of many other materials. The design of a new type of repetition plant has further enhanced the usefulness of chromatographic processing.[57]

British Patent 611,080 disclosed two different types of automatic mechanical isolation. The first method provides means for removing individual zones from the secondary material, while the second provides permanent systems of annular, perforated walls in radial separators. Temporary formation of bed-chambers can be neglected here. Before the use of the general principle in radial chromatography is discussed, however, some particulars of chromatographic combination columns may be given.

Fig. 2 illustrates such a combination column and its performance. As individual sections containing the chromatogram are removed, replacement sections with fresh adsorbent are moved into the corresponding separation positions. It has been found practical to replace a whole combination column, rather than individual sections, as disturbances of the chromatogram can thus be prevented. The column exchange takes place nearly instantaneously, and separation then continues while the removed column is disassembled, sectional concentrates isolated, secondary material reconditioned, sections repacked, and the column reassembled. Each part operation thus becomes a large scale, practically continuous operation going on in optimum environs.

Some difficulties encountered with combination columns occur also in radial chromatography. It has been found important to avoid "broken" column effects very carefully and to ensure continuity of the secondary material evenly through the column, inclusive of the perforations provided in plates or annular inter-walls. Care also has to be taken to prevent loss of material or intrusion of air while handling the removed sections. Engineering details have been discussed in the literature.[58,59,60] It should be pointed out that, analogous to column chromatography, replacement of the whole inner container provided with an appropriate system of concentric, annular inter-walls, into which the respective zones of the chromatogram are assembled, is now preferred to an exchange of individual sections from an inner container stationary in the separating position. Disassemblement of the system takes place in a central plant, and the contents of the individual bed-chambers are emptied into appropriate receivers for further processing.

Movable bed-chamber technique is a compromise between fixed bed technique and moving bed processes. Particulars of the process have been described in various papers.[61,62] A preliminary report of an industrial radial chromatographic plant was published in 1950,[63] and blue prints of a radial chromatographic pilot plant have been reproduced in *Canadian Chemical Processing*.[78]

Chromatography can now be imagined as an efficient unit-operation for the separation of fractions of crudes and distillates, and for preparing a wide range of hydrocarbons. As acknowledged in a very recent paper by Tiselius,[55] column chromatography originates historically as a scientific method from Day's research, itself based on previous practical experience of the refining industry. Modern chromatographic technology is nothing but a considered utilization of phenomena realized about 65 years ago in the industry. The difficulties caused by the batch character of chromatographic procedures had to be overcome to make possible chromatographic production. Details of individual chromatographic equipment will, however, depend largely on the properties of the stock to be processed, and will have to be devised according to the exigencies of the particular application.

(Manuscript submitted July 19, 1951.)

References

(52) C. Berg. "Hypersorption. A Process for the Separation of Light Gases." *Gas*, 23, No. 1, 37 (1947).

(53) C. Berg and W. E. Bradley. "Hypersorption—a New Fractionation Process." *Petroleum Engineer*, 18, 113 (1947).

(54) H. Kehde, R. G. Fairfield, J. C. Frank and L. W. Zahnstecher. "Ethylene Recovery — Commercial Hypersorption Operation." *Chemical Engineering Progress*, 44, 573 (1948).

(55) V. R. Deitz. "Chromatography by Adsorption." *Petroleum Processing*, 6, 853 (1951).

(56) E. B. Miller. "The Refining and Recovery of Petroleum Products with Silica Gel." *Transactions of the American Institute of Chemical Engineers*, 15, 241 (1923); see also *Oil & Gas Journal*, 23, No. 3, 104, 151, 158 (1924).

(57) R. L. Kruger. "Purification of Light Oils by Silica Gel for Motor Fuel Purposes." *Gas Age Record*, April 28, 1928.

(58) F. H. Spedding, E. I. Fulmer, T. A. Butler, E. M. Gladrow, M. Gobush, P. E. Porter, J. E. Powell, and J. M. Wright. "The Separation of Rare Earths by Ion Exchange. III. Pilot Plant Scale." *Journal of the American Chemical Society*, 69, 2812 (1947).

(59) H. Wei. "Industrial Chromatography of the Rare Earths." *Canadian Chemistry and Process Industries*, 33, 1036 (1949); see also H. Wei, "Chromatographic Technology in Radioisotope Separation." *Atomics* (London), 1, 230, 345 (1950).

(60) T. I. Taylor and H. C. Urey. "On the Electrolytic and Chemical Exchange Methods for the Separation of the Lithium Isotopes." *Journal of Chemistry and Physics*, 5, 597 (1937); see also "Fractionation of the Lithium and Potassium Isotopes by Chemical Exchange with Zeolites." *Ibid*, 6, 428 (1938).

(61) R. G. Russel and D. W. Pearce. "Fractionation of Rare Earths by Zeolite Action." *Journal of the American Chemical Society*, 65, 2781 (1943).

(62) B. J. Marr, A. L. Gabercault and F. D. Rossini. "Assembly and Testing of a 52-foot Laboratory Adsorption Column for Separation of Hydrocarbons by Adsorption." *Industrial and Engineering Chemistry*, 39, 1072 (1947).

(63) W. H. Stevens, D. and G. F. Gerhardt and Chumphy's. "Commercial Chromatographic Production." *Industrial and Engineering Chemistry*, 41, 218 (1949).

(64) P. F. Hopf, C. G. Lynam and H. Wei. "Improvements in or Relating to Chromatographic Adsorption Processes for the Separation and Purification of Substances." British Patent Specification No. 585,224 (Application date, July 14, 1944).

(65) P. F. Hopf. "Radial Chromatography in Industry." *Industrial and Engineering Chemistry*, 39, 928 (1947).

(66) G. Sgaia. "Lodoermimetro sestiteo. Teoria metodi ed applicazioni al 3 separatore di idrocarburi." *La Ricerca del Combustibile*, 2, No. 2, 79 (1948).

(67) C. G. Lynam and H. Wei. "Improvements in or Relating to Chromatographic Processes for the Separation and/or Purification of Substances." British Patent No. 635,271.

(68) C. G. Lynam and H. Wei. "Improvements in or Relating to Chromatographic Separation." British Patent No. 611,080 (A application granted).

(69) A. Tiselius. "Chromatographic Analysis," general introduction in *Discussions of the Faraday Society* (London and Edinburgh), No. 7, 7 (1949).

(70) H. Wei and T. I. Williams. "Autoradiochromatographie." *Anorganische Chemie*, 36, 457 (1951).

(71) H. Wei. "Industrial Oil and Fat Chromatography." *Paint Technology*, 14, 391, 439 (1949).

(72) H. Wei. "Column Chromatography and Radial Chromatography." *Canadian Chemistry and Process Industries*, 33, 956 (1949).

(73) C. G. Lynam and H. Wei. "Combination Columns in Chromatography." *Industrial Chemist*, 26, 109 (1950).

(74) H. Wei. "Application de la Chromatographie de Partage à l'Industrie." *Chimie et Industrie* (Paris), 64, 432 (1950).

(75) C. G. Lynam and H. Wei. "Movable Bed-Chamber Technique in Ion Exchange." *International Engineering and Process Industries*, 31, 276 (1950); see also H. Wei, "Sezione Intera con Processi Discontinui e Continui." *La Chimica e l'Industria* (Milano), 33, 287 (1951).

(76) H. Wei. "Prinzipien und Praxis der Chromatographischen Fabrikation." *Chemie-Ingenieur-Technik*, 23, 422 (1951).

(77) C. G. Lynam and H. Wei. "A New Plant for Radial Chromatography." *Manufacturing Chemist*, 21, 195 (1950).

(78) C. G. Lynam and H. Wei. "Radial Chromatographic Pilot Plant." *Canadian Chemical Processing*, 35, 471 (1951).

(79) A. Tiselius. "Some Recent Advances in Chromatography." *Endeavour*, 11, 5 (1952).

SPECIALIZATION **GIVES YOU UNIFORM HIGH QUALITY IN**

GLOBE ALLOY STEEL TUBES

When you specify GLOBE you get the finest, because Globe *specializes* in the production of steel tubes. For more than thirty years Globe *specialized* research, engineering and manufacturing facilities have assured customers of uniform high quality in alloy steel tubes for pressure or mechanical applications.

GLOBE STEEL TUBES CO., Milwaukee 46, Wis.
Chicago • Cleveland • Detroit • New York • Philadelphia
St. Louis • Denver • San Francisco • Glendale, Cal.

ucers of Globe seamless stainless steel tubes — Globeweld welded stainless steel tubes for alloy — carbon
nless steel tubes — Globeclad clad plate, rigid steel, stainless tubes — Globe Welding Fittings

GLOBE SEAMLESS TUBES FOR MAXIMUM STRENGTH AND MINIMUM WEIGHT

Pierced from solid steel billets . . . with no seams or welds Globe seamless tubes are available in many sizes and wall thicknesses for exacting applications.

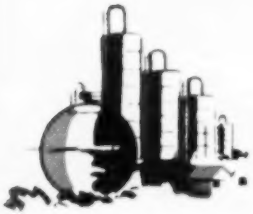
TYPICAL ANALYSES:

Carbon-Moly
¼ Chrome ½ Moly • 1¼ Chrome ½ Moly
Chrome ½ Moly • 2¼ Chrome 1 Moly
5 Chrome ½ Moly • 7 Chrome ½ Moly
9 Chrome 1 Moly
AISI 1335 • AISI 2517 • AISI 2512 •
AISI 4130, 4140 • AISI 4615 • AISI 8615,
8620, 8630, 8635, 8640 • 2½ Ni. • 3½ Ni.

TYPICAL APPLICATIONS

Pressure Tubes — Superheater Tubes — Condenser Tubes — Still Tubes — Evaporator Tubes — Barrel Tubes — Oil Well Pump Barrels — Mechanical Tubes — Aircraft Tubes — Rollers for Transmission Chains

Fields of activity indicative of Vulcan Engineering experience:



Fifty years of specialization in engineering for the Chemical Process Industries have yielded a wealth of experience and accumulated know-how which places Vulcan in a unique position to handle efficiently special problems in design and construction of chemical plants.

ORGANIC CHEMICALS	Synthesis, recovery, and purification of methanol, ethanol, propanols, butanols; formaldehyde, acetaldehyde, furfural; acetone, methyl-ethyl ketone; formic acid, acetic acid; esters, ethers, glycols, phenols, and halogen derivatives of oxygenated organic compounds.
PETRO-CHEMICALS	Production and refining of ethylene, ethylene oxide, ethylene glycol, ethanol, and other ethylene derivatives; isopropanol and methyl-ethyl ketone; butadiene, benzene, heptane, toluene, styrene, diphenyl; and chlorinated hydrocarbons such as chloraethane, chlorobenzenes, and chlorotoluenes.
PHARMACEUTICALS	Antibiotic production; fermentation pilot plants; recovery units for solvents utilized in antibiotic purification; and special production and separation processes for biochemical operations.
LOW TEMPERATURE GAS SEPARATION	Complete units for separation of low and high purity oxygen from air; hydrocarbon separations; low temperature vessels for storage and transportation of gases.
WASTE DISPOSAL	Concentration and combustion of aqueous organic chemical waste liquors, particularly liquors containing carbohydrate and ligneous components, with provision for heat and power recovery where economically feasible.
CHEMICAL RECOVERY	Absorption, extraction, and distillation processes for organic solvent recovery; sulfur dioxide recovery from sulfite pulp mill waste liquors and stack gases; and organic vapor recovery from vent gases.
EXTRACTION AND DIFFUSION OPERATIONS	Liquid-liquid extraction processes for recovery and purification of liquid and solid organic chemicals; the Vulcan-Kennedy liquid-solid extraction process for oil-seed processing, soluble coffee production; fiber washing and other specialized countercurrent diffusional operations.

Inquiries concerning process problems will receive prompt attention by the engineering staff.

VULCAN ENGINEERING DIVISION

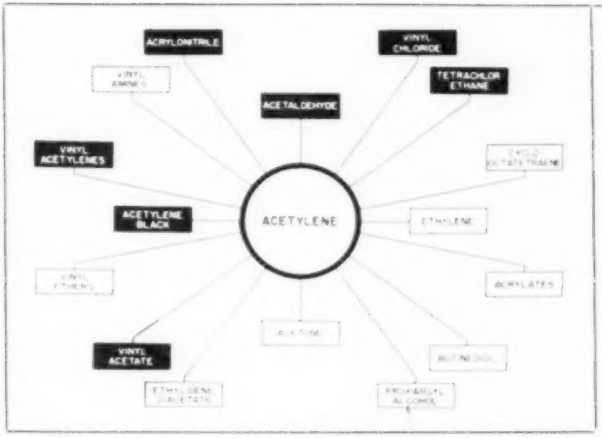
The VULCAN COPPER & SUPPLY CO., *General Offices and Plant*, CINCINNATI 2, OHIO

PHILADELPHIA BOSTON SAN FRANCISCO BUENOS AIRES

VICKERS VULCAN PROCESS ENGINEERING CO., LTD., MONTREAL, CANADA

51 YEARS OF SERVICE

ENGINEERING DIVISION • MANUFACTURING DIVISION • CONSTRUCTION DIVISION • INDUSTRIAL SUPPLY DIVISION



THESE CHEMICALS are the primary derivatives of acethylene. Those in the dark rectangles are produced on a large scale[1]

ACETYLENE

Coming Petrochemical Building Block?

By V. B. GUTHRIE, Editor

ACETYLENE, by no means a newcomer among the volume hydrocarbons is fast pushing into the limelight as a base material for the manufacture of organic chemicals. This compound, produced over the years from calcium carbide, is now also being made commercially in the Southwest from natural gas.

Two natural gas-acetylene processes are available for license by oil and chemical companies in this country and Canada. One of the processes, some technologists believe, has been developed to the point it may be applied to produce acetylene by cracking propane, butane, LPG mixtures, or possibly heavier petroleum hydrocarbons. This might make the refiners party to the manufacture of acetylene, other conditions being favorable.

Taking part in the present development work on acetylene from natural gas as a building block for chemicals are Carbide and Carbon Chemicals Co. and Monsanto Chemical Co., both large producers of the calcium carbide source of acetylene. American Cyanamid Co., large producer of chemicals which could stem from acetylene perhaps more economically than from other material, is sponsoring a natural gas-acetylene process and is building a large commercial plant for its own operations. Tennessee Eastman Co. a division of Eastman Kodak Co. has done experimental work with one natural gas-acetylene process.

General Aniline & Film Corp. is carrying on successful pilot plant work in the high-temperature, high-pressure processing of acetylene, which may greatly widen its scope as a commercial source for organic chemicals. So far the oil companies do not appear to be taking part in the field of the application of acetylene for chemicals manufacture.

Readers on the shady side of 60 will remember when acetylene made from carbide came into fame by supplying light for bicycles in the early 1900's. It soon found larger markets as a lighting gas and for fuel used in welding and flame cutting. There are reasons, some economic, some technological, why acetylene now is assuming a new and more prominent role as the starting point for a number of the chemicals which are important in today's way of living.

Acetylene (C_2H_2) has long been regarded by chemists as the "universal organic chemical building block", if certain processing, handling and other technical difficulties could be overcome. Its versatility arises largely from the fact that acetylene contains a triple bond between the carbon atoms. It can pick up, for example, two carbon atoms and still remain unsaturated and possible of a further reaction. On the other hand, ethylene, a double-bonded molecule, becomes saturated after such a reaction has taken place.

Acetylene has other properties, some of which pose ticklish engineering problems in processing it. It is an endothermic compound, its heat of formation being 3870 btu./lb. This means that in practically every chemical reaction large amounts of heat are evolved. Acetylene and oxygen form explosive mixtures at low concentrations of each. It will decompose under suitable stimulus in large pipes and or moderate pressures.

Acetylene and chlorine react explosively in daylight. Because of its triple bond it forms acetylides with many metals, some of which are obnoxious and dangerous.

Economics Chief Factor

The chief reason why acetylene is being considered as a source for organic chemicals is economic. Ethylene (C_2H_4) is the present source for many chemicals, including two which are just now coming into really large volume de-

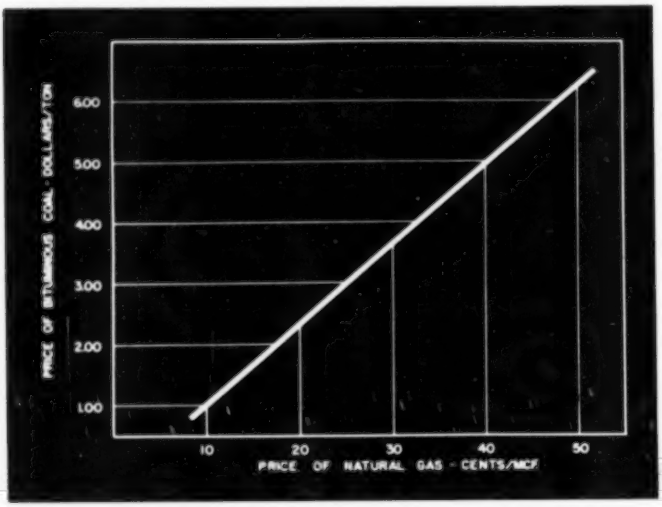


FIG. 1—COST RELATIONSHIP between natural gas and coal in the manufacture of acetylene[1]

mand. One of these is acrylonitrile, the base material for the synthetic fibers which are already appearing in the clothing we wear, and for the soil conditioning chemicals introduced only a few months ago and already to be found in the seed merchants' stocks. The other chemical is vinyl chloride, base for raincoats, the Army's ponchos and many other water repellant materials.

Chemical manufacturers always keep an eye cocked for an alternate source or method for securing their large-volume products, either to turn to in the event of a shortage in their present main supply or as a lower cost means of production. Acetylene may provide an answer to both problems. Ethylene now finds a ready market for all that is being produced, it is said, and is selling at 7c lb. at some locations, representing a steady advance the past year or so. Ethylene oxide, from which acrylonitrile is manufactured, sells today at 19c lb. in tank cars delivered at eastern points. It takes 0.8 lb. of ethylene oxide to make a pound of acrylonitrile. Thus the cost of the raw material is a substantial part of the present cost of acrylonitrile, which sells for 45c lb. f.o.b. works.

On paper, at least, it appears more economical to make acrylonitrile from acetylene. The raw material requirements would be lower, since only 0.5 lb. of acetylene is required for the reaction. In Germany acrylonitrile is manufactured from acetylene by the direct addition of hydrogen cyanide. This method is said to be apparently more economical than the two-step process from ethylene and may be used in this country.

However, the advantages are not entirely on the side of acetylene made from natural gas. It is produced in low concentrations. Equipment cost for purifying the natural gas acetylene and the more complex purification of acrylonitrile made from acetylene also contribute to higher costs. Another advantage for ethylene is that ethylene oxide facilities now in existence are nearer markets for acrylonitrile than the commercial natural gas processing units now being installed in the Southwest.

The same relative comparison between ethylene and acetylene is said to hold for vinyl chloride, and other chemicals. In none of these instances, however, are data yet established on costs of the basic acetylene for manufacturing chemicals. To the present time the acetylene industry has been built up largely on handling the gas in cylinders convenient for welding, lighting, metal cutting and similar usages. Costs of the acetylene to chemical manufacturers taking it by pipeline from the acetylene producing point are based on individual circumstances, and at present differ widely.

Carbide vs. Natural Gas

The manufacture of calcium carbide from coke and lime in an electric furnace has been a commercial business for about 50 years. It has not been changed fundamentally, although many improvements have been made which have resulted in reductions in cost. The acetylene is manufactured from the carbide by either a "wet" or "dry" process, the latter being more economical for large-scale production provided there is a market for the by-product, dry lime hydrate. Calcium carbide is convenient to transport by rail or motor truck to the point of acetylene manufacture.

The power required to produce acetylene by the carbide route is approximately 5 kilowatt-hours per pound. Carbide plants are thus often found near sources of large blocks of cheap power, although proximity to cheap coal or lime are also influencing factors. "There is probably slightly over 1,000,000 tons of annual carbide capacity in existence or under construction today, the principal portion of which is used to generate acetylene for chemical purposes", Dr. H. S. Sutherland, vice-president Shawinigan Chemicals Ltd., Montreal, told the International Acetylene Assn., at its recent annual meeting."[1]

The costs of concentrating and purifying the acetylene produced are heavier cost factors for the gas processing plants than for the carbide plants, authorities state.

The inherent advantages of the carbide process for producing acetylene over gas processing emphasize the importance of the price trend of natural gas. Fig. 1, also from Dr. Sutherland's paper, shows the relationship between the cost of natural gas and the cost of coal in the large-scale manufacture of acetylene by the Sachse and carbide processes. The Sachse process, developed originally by Badische Anilin and Soda Fabrik in Germany, is the type operated or under construction by two large chemical companies in Texas, and is said to appear to be the most efficient process to date for the manufacture of acetylene from natural gas. In the case of the carbide process it is assumed that power and coke are made from coal. The author states the relationship is open to criticism in that the figures for the Sachse process are optimistic, since it is a new process, while the carbide figures are dependent on many factors which must be assessed in the individual case. "Nevertheless," he states, "It is indicated that when your coal and power equivalent is as high as $6 per ton you can afford to pay quite high prices for natural gas."

Such economic comparisons of the carbide and the natural gas routes for acetylene of necessity overlook two points that may have an important bearing on the case. The first is the possibility of the discovery of large new reserves of natural gas in this country which might affect its price trend. Second is technological advances in processing to make acetylene which might make the price of

gas relatively less of a factor than at present. As compared with the technology of the carbide process, the manufacture of acetylene from natural gas is in its infancy and new methods or further improvements in present methods are to be expected.

Acetylene Technology

It has long been recognized that low concentrations of acetylene could be produced by the decomposition of saturated hydrocarbons. An electric arc was the early preferred means for effecting the decomposition. Union Carbide and Carbon Corp., of which Carbide and Carbon Chemicals Co. is a present division, in the early 20's initiated work on the production of acetylene by cracking hydrocarbons. It became so impressed with the possibilities of ethylene as a source for organic chemicals that the acetylene project was sidetracked. Union Carbide, through another division, became the largest producer in the U. S. of calcium carbide for acetylene manufacture.

Out of the early development work in producing acetylene by cracking saturated hydrocarbons, usually natural gas, has come four principal methods, two electrical and two thermal. The electrical processes are the Schock process, developed at the University of Texas and utilizing a low-temperature arc, and the Huls process developed in Germany, in which a high-temperature arc is employed. The latter process was operated extensively during the war to make acetylene for Germany's synthetic rubber. Neither of these processes is in commercial operation in this country. The two thermal processes for producing acetylene are the German Sachse process, which involves the partial oxidation of natural gas or methane, and the Wulff process, which uses a regenerative-type furnace for high-temperatures, low-pressure vapor phase cracking.

The major acetylene-from-natural gas installations in the Southwest are of the Sachse process, or modifications of it. The Carbide and Carbon Chemicals Co. is expanding its operation at Texas City, which produces acetylene used in making vinyl resin intermediates (vinyl chloride and acetate) and as by-products carbon monoxide and dioxide, methyl acetylene, diacetylene, vinyl acetylene and smaller quantities of other materials. The installation for Monsanto Chemical Co. at Texas City will be a part of its acrylonitrite plant now under construction. The process is believed to be similar to that of Carbide.

American Cyanamid Co. will use the Badische process, a modification of the Sachse process, for making acetylene from natural gas at the $60,000,000 plant just announced to be built on the Mississippi above New Orleans. The installation as originally projected will produce acetylene, ammonia, hydrocyanic acid and derivatives, including acrylonitrile and ammonia sulfate. Chemical Construction Corp., New York engineering firm, a wholly owned subsidiary of American Cyanamid, holds the North American rights on the Badische process, originally developed by the Badische Anilin and Soda Fabrik in Germany.

The Wulff regenerative furnace process for making acetylene from hydrocarbons, first described in 1942,[1] has come to general attention again. The Wulff Process Co. of the West Coast has announced it has entered into arrangements with Lummus Co. (New York), Fluor Corp. (Los Angeles) and Girdler Corp. (Louisville, Ky.), all refinery engineering firms, to design and construct Wulff process units for making acetylene and ethylene. The Wulff interests have operated a commercial size pilot plant at Maywood, Calif., for 18 months, the past 9 on continuous production of acetylene.

The process is described as using natural gas, ethane, propane, butane or any LPG mixtures as feed stocks, and may be applied to the manufacture of acetylene, ethylene or the simultaneous production of both acetylene and ethylene. Some refinery technologists believe this process may be applicable to the production of acetylene in refineries through the cracking of propane or butane or even heavier hydrocarbons.

More Service Processing

The scope of chemicals to be manufactured from acetylene may be widened through pilot plant work being done by General Aniline & Film Corp. at Grasselli, N. J., on high-temperature, high-pressure processing of this compound. The experimental plant is the first to be erected in this country to exploit the high-pressure acetylene reactions developed in Germany by Dr. J. Walter Reppe, an I. G. Farben chemist. These reactions provided Germany with many essential war chemicals, notably for the production of synthetic rubber, pharmaceuticals and synthetic fibers. Special techniques have been developed by General Aniline to permit the safe use of acetylene at elevated temperatures and pressures.

In line with the broadening field of acetylene chemistry, the International Acetylene Association has enlarged its activities. This trade organization of some 150 companies was started in 1898 and to the present its help has been largely in supplying information on the handling and application of acetylene in welding and flame cutting, and on the manufacture of acetylene from calcium carbide. Now it proposes to follow developments in acetylene as a base for chemicals manufacture as well as in the production of acetylene itself.

"Twenty-five years ago," said one speaker at the association's annual meeting in Indianapolis March 31-April 2, "a discussion of chemicals from acetylene would probably start with a description of methods for generating acetylene from calcium carbide. Today, however, we must decide from which source we wish to obtain our gas. In other words, not only whither acetylene but also whence acetylene."

In line with its new program a symposium on "Chemicals from Acetylene" was a feature of the meeting. The economic and technological factors influencing some of the chemicals made from both acetylene and ethylene were compared, to give a better insight into their possible respective futures. Specific products were analyzed in papers by Clayton F. Ruebensaal, Commercial Development Manager, Naugatuck Chemical Division, United States Rubber Co.[3] and others. Following is a summary of their combined remarks on a few of the chemicals now made in volume and possible of being derived from either acetylene or ethylene:

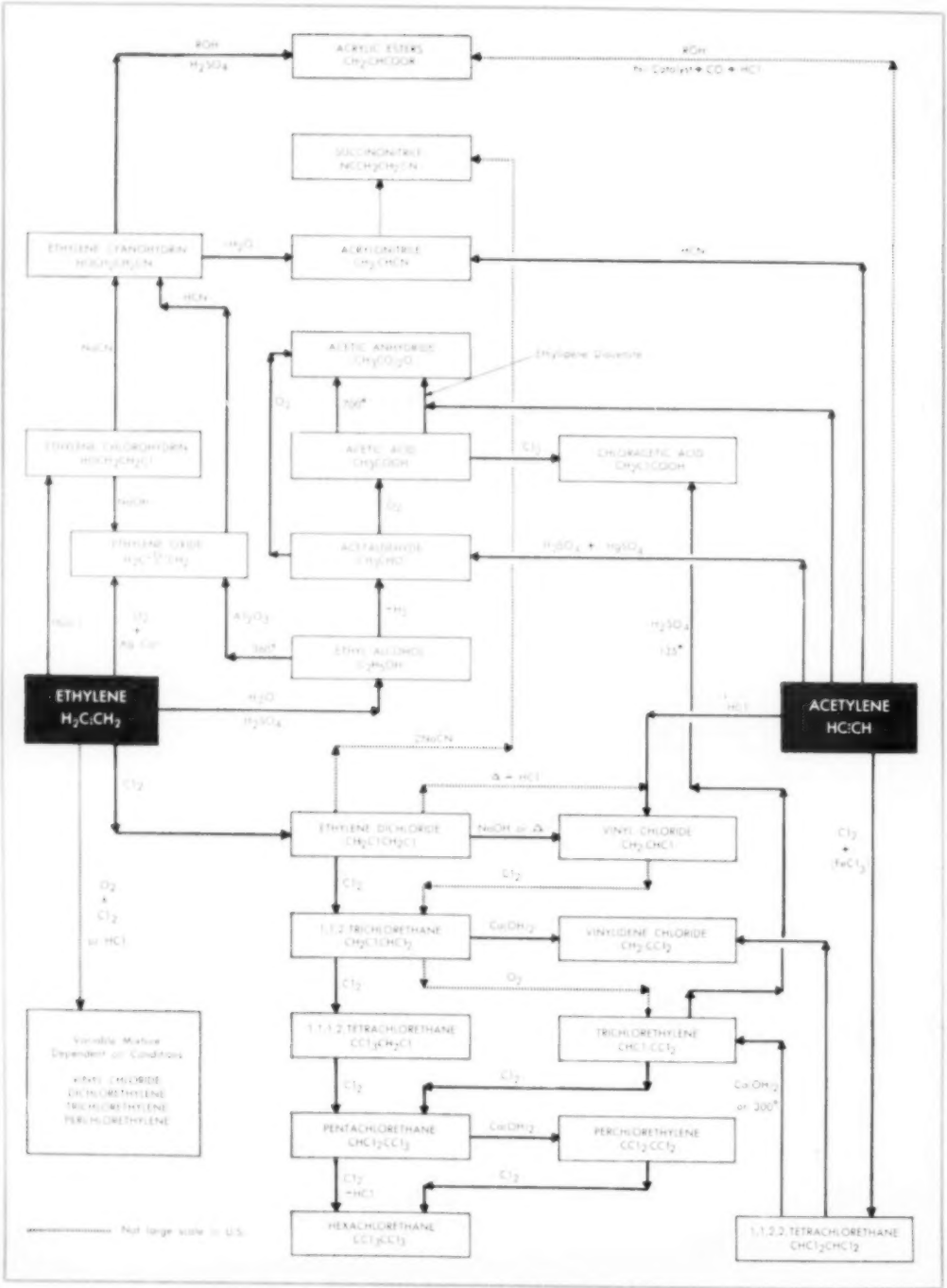
Acetylene vs. Ethylene as the Building Block

Vinyl Chloride

Monomeric vinyl chloride (CH_2=$CHCl$) used in the polymerization of synthetic resins has grown from a production of about 70,000,000 lbs. in 1945 to over 280,000,000 in 1950. A growth to 600,000,000 lbs. annually in the next 5 years is forecast.

It is used principally in preparing polymers and copolymers for elastomeric and rigid plastics used to form films, fibers, sheeting and moldings. Its versatility alone or in blend with other resins and rubbers has brought it to the highest consumption of any single component in the plastics industry today. The flexibility which permits its polymer form to be processed on about every type of plastic or rubber fabricating machine has made it the workhorse of the thermo-plastics field.

Of all chemicals manufactured from either ethylene or acetylene, vinyl chloride commands a unique position. Ethylene dichloride from ethylene was used in the early 30's to make the initial production of vinyl chloride. The monomer was produced by em-



EITHER ETHYLENE OR ACETYLENE can be used as the starting raw material for these chemicals.

ploying caustic soda to strip off a hydrogen chloride molecule from the dichloride. Later its manufacture was shifted to the addition of hydrogen chloride to acetylene, which accounted for all the production of the monomer until late in the 40's. Then plants were built in the Southwest for its production by thermally cracking ethylene dichloride. Today vinyl chloride is made via both the acetylene and ethylene routes, with the former having the edge by the ratio of about 55 to 45%.

Additional capacity is now being installed in the Southwest for production of vinyl chloride from ethylene and chlorine in a two-step process. Despite this, however, acetylene will continue to hold its own, with the balance swinging toward acetylene utilization through the expansion of vinyl chloride production from natural gas-derived acetylene in Texas.

When vinyl chloride is produced by thermally cracking ethylene dichloride, the hydrogen chloride which is split off may be reacted with acetylene to yield another molecule of vinyl chloride. It is feasible that a natural gas cracking operation such as the Wulff process, which yields both acetylene and ethylene, could be utilized to produce vinyl chloride by the addition of chlorine to the ethylene-acetylene mixture. Other patents involving the combined oxidation and chlorination of ethylene, although not commercially developed, may offer still another system for producing this versatile monomer. In addition to the vinyl chloride, variable quantities of di-, tri-, and perchlorethylene are formed. This system might provide a manner for manufacturing chlorinated solvents which would be competitive on a large scale with the established processes involving the direct chlorination of acetylene.

Acrylonitrile

Acrylonitrile ($CH_2{:}CHCN$) is a comparative newcomer to the family of acetylene-derived chemicals. The end uses for it are expanding at a fabulous rate. In 1950, about 85% of the production capacity of 20,000,000 lbs. was divided between the Buna N oil resistant rubbers and the man-made fibers Orlon, Acrilan, Dynel and Fiber X-51. The remainder was used in other applications including plastics.

New expanded plants for these materials coupled with the newly developed soil conditioners, high impact plastics and blends of Buna N rubbers with vinyls and phenolics will push the total demand to over 200,000,000 lbs. in the next few years. Estimates for its annual capacity in the next 10 years range from 500,000,000 to 800,000,000 lbs.

At present all the industrial production is from ethylene via the dehydration of ethylene cyanohydrin. New manufacturing capacity to be completed during 1953 will utilize direct addition of acetylene and hydrogen cyanide, both derived from natural gas. Estimates of 70,000,000 to 100,000,000 lbs. have been placed on the capacity of this equipment, which is two to three times the country's total existing capacity. Other plants planned for Louisiana and West Virginia will increase this total.

Production of acrylonitrile from carbide acetylene and hydrogen cyanide was carried out on the West Coast and in Germany during the last war. Despite large-scale plans for acrylonitrile from natural gas-acetylene and projected expansions for the ethylene cyanohydrin synthesis, pilot plant work continues on reaction of carbide acetylene and hydrogen cyanide. Possibilities also exist for production of acrylonitrile directly from ammonia and natural gas without resorting to separation of the intermediate acetylene and hydrogen cyanide which are formed.

Acetaldehyde

Acetaldehyde (CH_3CHO) is one of the most important intermediate aliphatic chemicals, serving as raw material for the manufacture of acetic acid, acetic anhydride, aldol and others. In fact, 95% of its output is utilized for further synthesis in the plant in which it is made. Its manufacture increased to over 600,000,000 lbs. in 1950. Almost the entire country's capacity was once synthesized through the hydration of acetylene. In recent years the synthesis via ethyl alcohol from ethylene has accounted for most of the expanded demand. The ethylene route is itself losing some markets to an alternate and seemingly more economical route involving the air oxidation of propane and butane, which is being carried on here and in Canada.

The modified Fischer-Tropsch or Hydrocol process involving the oxidation of ethane and propane is yet another process which may invade the acetaldehyde market. Although the availability of acetylene at low cost from methane may bring the hydration of acetylene back into the economic picture, it appears the oxidation of lower hydrocarbons will be the most promising for future expansions.

Acetaldehyde is produced by the addition of water to acetylene. The original patents were taken out in Germany and developed into a workable process in Canada during World War I. Since then improvements have been made and production increased both in the U. S. and Canada. During World War II most of the acetaldehyde in Germany was made from acetylene.

The process consists of circulating high-purity acetylene through a reaction vessel containing mercury sulphate and dilute sulfuric acid. Approximately 25% of the acetylene is converted into acetaldehyde per pass at very high yields. The acetaldehyde is recovered by condensation and water scrubbing and the acetylene is recirculated. The aqueous acetaldehyde is distilled to produce a product of 99% purity. The process has stood the test of time, probably on account of the large throughput possible and the ease of dissipating the large heat of reaction by this method.

Other Chlorinated Hydrocarbons

It is known that the manufacture of tetrachlorethane from chlorine and acetylene has increased considerably since the last estimate of 400,000,000 lbs. annually in 1948. The tetrachorethane is dehydrohalogenated to trichlorethylene using lime or thermal cracking. By subjecting this intermediate to chlorination and subsequent dehydrohalogenation, pentachlorethane and perchlorethylene are formed. The trichlorethylene and perchlorethylene, respectively, find large markets in the metal degreasing and dry cleaning industries.

An advantage of the acetylene route over direct chlorination of ethylene arises from the fact that six chlorine atoms are used to arrive at the trichlorethylene step via ethylene, whereas only four atoms are used to effect the same degree of chlorination with acetylene. However, an alternate oxidation technique may be utilized to arrive at trichlorethylene from 1,1,2-trichlorethane. This results in all the chlorine being used for salable products instead of being lost as calcium chloride as in the case of trichlorethylene from tetrachlorethane.

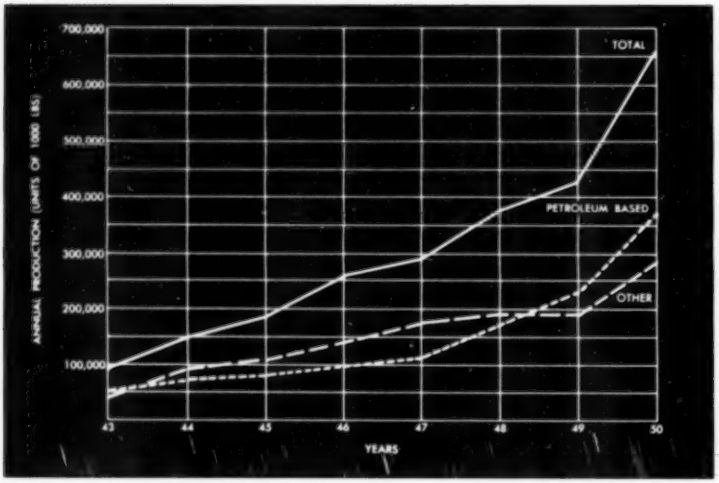
Another polymerizable chlorinated hydrocarbon which can be made from either ethylene or acetylene is vinylidene chloride. This monomer copolymerized with small amounts of vinyl chloride yields rigid corrosion-proof plastics. When vinyl chloride is the predominating comonomer, soluble or low melting point copolymers are formed. This monomer is synthesized from 1,1,2-trichlorethane when ethylene is used as the starting material or from tetrachlorethane made from acetylene.

References

(1) "Chemical Uses of Acetylene." Dr. H. S. Sutherland, vice president, Stauffer Chemical Co., Montreal, before Annual Meeting International Acetylene Assn., Indianapolis, March 31-April 2, 1952.

(2) "Acetylene and Other War Chemicals Made by Cracking in a Regenerative Furnace." Technical Section, National Petroleum News, Aug. 20, 1942, p. R-570.

(3) "Trends in the Manufacture of Chemicals from Ethylene and Acetylene." Clayton F. Hutchison, Commercial Development Manager, Separations Chemical Division, United States Rubber Co., before Annual Meeting International Acetylene Assn., Indianapolis, March 31-April 2, 1952.



PETROLEUM-BASED DETERGENTS have well outstripped those from other sources since 1948.

Detergents from Petroleum

Output has jumped 650% in 7 years as result of ample raw materials, simple processing needs

By FOSTER DEE SNELL
Foster D. Snell, Inc., New York

CRACKING and modern synthetic processes have made petroleum an outstanding source of numerous industrial organic compounds. Use of such petroleum products in the mushrooming synthetic-detergent industry has been catalyzed by a world-wide fat shortage.

Since introduction of the first synthetic detergents, the sodium alkyl sulfates, ROSO$_3$Na, numerous other types of detergents have appeared. The most widely used and most rapidly expanding synthetic detergents (hereafter abbreviated to *syndets*) are the alkyl aryl sulfonates, RC$_6$H$_4$SO$_3$Na, in which the hydrocarbon group is based on readily available petroleum fractions rather than on the more expensive vegetable oils. These petroleum-based detergents have excellent detergent properties in both hard water and acid solution and can be produced cheaply and in volume.

For this reason numerous soap manufacturers are expanding their facilities to provide for production of syndet products using an alkyl aryl sulfonate as the active agent.

Due to the ready availability of the raw materials required, the simple process involved, and the relatively small plant investment, even modest-scale soap manufacturers who have entered this field have found that they can successfully compete in a local market with the larger manufacturers and their nationally known products. The scale of such operations varies from a few tons a month to many tons a day of built synthetic detergent.

Progress in the production of organic surface-active agents is shown in Table 1 and the chart for the period covering the late war years to date.

The figures include all types of organic surface-active agents such as emulsifiers and wetting agents as well as syndets. The figures are reported on a basis of 100% active material that is free from inorganic salts or other ingredients. They show the growth in the production of this material from some 50,000,000 lbs. of petroleum-based products in 1943 to about 370,000,000 lbs. in 1950.

Table 1—Production of Organic Surface-Active Agents

(From U. S. Tariff Commission Data)
Units of 1000 lbs.

Year	Petroleum Based	Other	Total
1941	34,559	55,141	89,700
1942	74,254	78,402	152,656
1943	50,961	100,430	151,391
1944	70,845	142,361	213,206
1945	152,897	178,474	331,371
1946	177,237	196,978	374,215
1947	252,721	196,805	449,526
1950	371,802	286,268	657,870

Surface-active agents embrace a bewildering variety of molecular types. Only a fraction of these make good detergents, and a still smaller fraction have been manufactured and achieved commercial success. Our attention will be focused on these.

Properties of Syndets

By virtue of their tendency to concentrate and orient at interfaces, syndets exhibit in solution a series of special properties in various degrees. These include wetting power or ability to wet a surface more thoroughly than will water; foaming power; emulsifying power or ability to separate oil droplets and prevent their coalescing; dispersing power or ability to separate solid particles and prevent their redeposition; and micelle formation or ability to solubilize certain substances.

As may be gathered, detergency is a very complex process. It is a composite of wetting power, dispersion and emulsification, electric charge, and solubilization. The relative importance of these factors and the manner in which they cooperate are not understood too clearly even in

qualitative terms, and practically no progress at all has been made towards setting up a mathematical function.

There is no doubt that the relative importance and roles of the fundamental factors vary, depending on the particular system. The nature of the soil, the nature of the base material, the temperature, the type and amount of agitation, etc., affect the situation. Thus, basic theory does not provide complete answers to even simple problems in the field of detergency. Despite that, it is very helpful by eliminating in advance many substances and many methods which can be "calculated" to be inferior, and by suggesting the materials and conditions which are likely to give best results, necessarily subject to experimental confirmation.

Molecular Structure

The most important property of syndets—their tendency to concentrate and orient at interfaces—exists because they all consist of "schizophrenic" or "split-personality" molecules. A molecule of a syndet is in part nonpolar. The nonpolar portion is a hydrocarbon ring or chain. The rest of the molecule is polar. The polar section is usually a sulfate, sulfonate, carboxyl, or polyoxyethylene group. The nonpolar portion is water-insoluble, while the polar group is water-soluble. Hence the latter drags the hydrocarbon group into solution. However, the hydrocarbon section of the molecule is reluctant to be dragged in.

Changing this to a loftier scientific plane, we may say that the solution of a synthetic detergent in water involves a net decrease in free energy for the polar group and a net increase in free energy for the hydrocarbon group. The fact that the material dissolves at all shows that the net free energy change is negative; hence the decrease is greater than the increase. When an oil-water interface is present, detergents will concentrate there and will orient so that the hydrocarbon portions of the molecules are in the oil and the polar portions of the molecules are in the water. That represents a state of still lower free energy. The polar sections of the molecules are still dissolved in water, so there the free energy has not changed, but the hydrocarbon portions are in a solvent which they like rather than in a solvent which they have been dragged into.

Similarly, when such molecules concentrate at an air-water interface the hydrocarbon sections of the molecules are partially surrounded by each other and partially exposed to air. From the free-energy standpoint this represents an environment preferable to water. Finally, in micelles, the molecules are so oriented that the polar groups face outward toward the water while the hydrocarbon tails point inward toward each other. Thus, the hydrocarbon groups may be said to be dissolved in each other and are out of contact with water.

It follows that designing a molecule for a syndet can be somewhat elaborate. First, the hydrocarbon base must be selected. As will be seen, this is often produced synthetically. Then a polar group or a series of polar groups must be selected. The hydrocarbon and polar sections of the molecule must be so balanced that they will in conjunction achieve the desired effect for the intended applications. The balance and design of the molecule is different for a wetting agent from that of a detergent, or that of a product intended primarily for emulsifying mineral oils.

Next, decision must be made as to how to link the polar group or groups and the hydrocarbon section together. Linkage may be through an ester bond, an ether bond, an amide bond, or otherwise, and is frequently chosen on the basis of convenience and economy on an industrial scale. The nature of that bond may be a limitation on the applicability. For example, esters are not stable in strongly alkaline or strongly acid solutions.

The anionic detergents ionize in water solution to form anions which are of fairly high molecular weight and are surface-active, as well as cations which are usually simple inorganic ions, most commonly sodium. The non-ionic detergents do not ionize in solution. Most commonly, the polar groups in non-ionic detergent molecules consist of polyoxyethylene chains linked to the hydrocarbon portions of the molecules by ether or ester linkages. Cation-active agents ionize to form surface-active cations and simple inorganic anions, such as bromide or chloride. Cationics are not much used as detergents although they can be used to some advantage in certain wool-cleaning operations.

In terms of tonnage production or money value, the anionics are by far the most important general class of detergents. This is true even if we omit soaps, which are technically a type of anionic detergent. The nonionic detergents are not used to nearly as great an extent, but they have been gaining rapidly in the last few years. The cationics are employed mainly as germicides and disinfectants and will not be discussed.

From this general picture of molecular structure we see that different general types of surfactants can be designed—anionic, cationic, and nonionic—and that also within each type great variation in molecular structure is possible. Emphasis here will be given to petroleum-derived products.

Alkyl Aryl Sulfonates

Among the syndets, many advantages are associated with the petroleum-based alkyl aryl sulfonates, although they also possess some disadvantages. Their properties may be listed as follows:

Advantages

1. The raw materials are among the most available and the least expensive, and the active agent can be built with low-cost inorganic salt to reduce prices at which it must be offered. Alkyl aryl sulfonates are the "work horses" among the synthetic detergents.

2. Only standard process equipment is required and the process has been so thoroughly applied that experimental work is at a minimum.

3. The molecule has considerable adaptability in that it can be tailored by adjusting the length of alkyl chain.

4. The products show good chemical stability and have good solubility.

5. The existence of producers of non-sulfonated "keryl" benzene from petroleum makes it possible for a

Meet the Author

Foster Dee Snell received his B. S. degree from Colgate University and M. A. and Ph. D. degrees from Columbia. He taught chemistry at Columbia and at the College of the City of New York and was in charge of Technical Chemistry at Pratt Institute from 1923-28. He was a member of the Referee Board of the Office of Production Research and Development from 1941-45. He is president of Foster Dee Snell, Inc., New York, consulting chemists and engineers. He has been president of the American Institute of Chemists and vice-president of the Society of Chemical Industries (England) and received the Society's Medal for 1949.

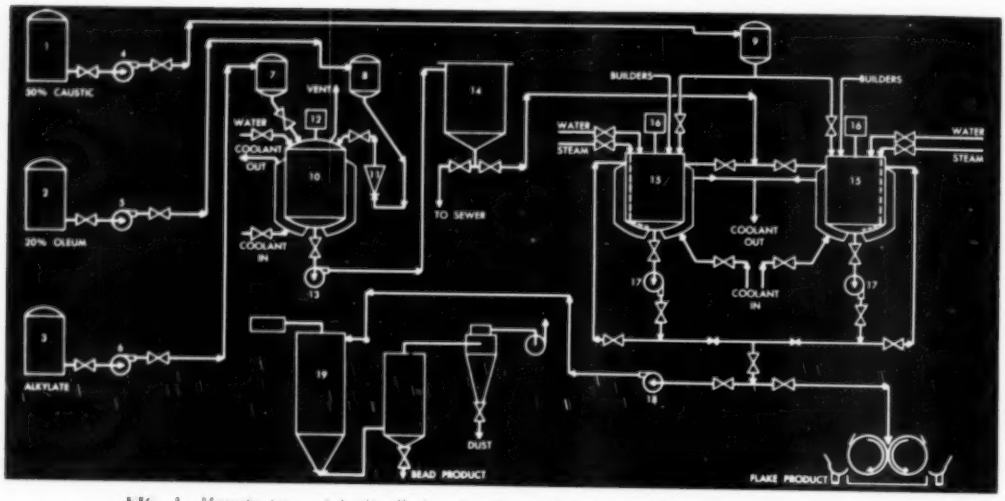


FIG. 1 Manufacture of built alkyl-aryl sulfonated detergent in 20% oleum batch process

newcomer to enter the field at a capital investment which is far less than would be required were he to begin the complete manufacture of such a product. This means that returns can be secured with minimum capital commitments, often by piloting the market by initial manufacture from purchased slurry. Keryl is a term used for an alkyl chain-length corresponding to that in kerosene.

6. The production costs are lower than those of any other detergent.

Disadvantages

1. There is a tendency to develop unpleasant petroleum odors on prolonged storage. The use of odor odors as is common with soap should become standard practice by the manufacturers.

2. The product sometimes has a yellowish color which is a drawback when it is to be used as a mechanical mixture with white substances for packaging or when the consumer compares it with other non-soap detergents.

3. The foam from this material is unlike that of soap, although alkyl aryl sulfonates will produce almost as much foam as any other syndet produced on a large scale. It is composed of larger bubbles than those in soap foam.

4. Alkyl aryl sulfonates are less desirable than sodium alkyl sulfates for personal and cosmetic use. The former leave the skin feeling rather sticky and later, dry and harsh. This is less of a drawback for use in dish-washing, house-cleaning, etc. than for shampoos and personal cleansers.

5. The sulfonates cannot be built with inorganic salts as far as the sulfates and retain good performance. Thus twenty per cent of sodium lauryl sulfate, properly built with inorganic salts, will perform well under conditions which would require somewhat more of various alkyl aryl sulfonates. This reduces the cost gap between sulfates and sulfonates.

6. The products are often hygroscopic.

Production of Alkyl Aryl Sulfonates

Alkylate, supplied by a number of large oil companies, is a combination of an aryl radical with a petroleum fraction boiling at 315-575° F. (175-300° C.). The alkylate is sulfonated, neutralized, then mixed with various "builders" to improve detergent action.

In the building of synthetic detergents there have been two distinct phases. For "light duty" cleaning, or removal of light soil, low-cost sodium sulfate and sodium chloride were made a part of Naccogol, Santomerse, Dreft, Igepons, etc. Sodium sulfate was ordinarily formed during the manufacturing process, and was not separated unless an unusually high active-agent content was required. In these products the proportion of inorganic builder varied from 60 to 80%.

As a later phase, "heavy-duty" detergents were developed for the removal of heavy greasy soil and for more effective general cleaning. These contain molecularly dehydrated phosphates such as tetrasodium pyrophosphate and sodium tripolyphosphate as important ingredients of the builder mixture. Another builder which has come into general use is sodium carboxymethylcellulose (CMC). This material serves to promote detergency by preventing redeposition of soil suspended in the wash solution. This property of CMC is particularly noticeable with the syndets, the soil-suspension characteristics of which are relatively poor compared with those of soap, particularly when used in washing cotton textiles.

It is the development of these heavy-duty built syndets containing molecularly dehydrated phosphates and CMC which has helped boost production to its present semi-astronomical level. Thus, the relative amounts and kinds of the various builders to be incorporated in a syndet formulation depends on the use to which the product is to be put.

Among the less important additives are perfumes and optical bleaches. The latter may be described as fluorescent colorless dyes, incorporated exclusively in products destined for household use to give fabrics an appearance of greater whiteness.

Process

The five basic steps involved in the manufacture of a typical alkyl aryl sulfonate detergent are: 1) sulfonation, 2) spent acid separation, 3) neutralization, 4) building, and 5) drying.

Sulfonation

Referring to the batch-process flow sheet Fig. 1, a measured amount of alkylate is pumped from storage (3) to the measuring tank (7) and thence flows by gravity to the sulfonator (10), where it is precooled under agitation to about 50° F. (10° C.). While this precooling is taking place, the sulfonating agent—20% oleum—is pumped from storage (2) to a measuring tank (8) located above the sulfonator.

An oleum to alkylate ratio of 1.25:1

will result in a final spent-acid concentration below 100% of sulfuric acid, indicating that part of the sulfur trioxide required is obtained by dissociation of the sulfuric acid into sulfur trioxide and water. The same ratio will result in an average heat release of 175-190 Btu./lb. of alkylate.

When the alkylate in the sulfonator has been sufficiently cooled, addition of 20% oleum from the feed tank through a meter (11) to the sulfonator is begun. From this point on, efficient agitation and cooling of the reaction mass is a "must", in order to prevent localized overheating and possible discoloration of the product. The rate of feed of the oleum must be carefully controlled so as to maintain the reaction temperature at about 77° F. (25° C.) and not allow it to rise above 85° F. (30° C.).

After addition of oleum to the reaction mass, agitation of the mixture is continued for a period of about 2 hrs. at about 77° F. (25° C.).

Spent-acid Separation

The next step in the manufacture of the alkyl aryl detergent is, in most cases, removal of the spent sulfuric acid from the reaction mass. Where a relatively high percentage of sodium sulfate is desired in the finished product as in the case of a light-duty detergent, the spent acid is allowed to remain with the sulfonic acid so that when neutralized it will produce the desired sodium-sulfate content in the finished product. However, in the case of a heavy-duty detergent, maximum separation is essential.

To accomplish the spent-acid separation efficiently, the aged mixture is diluted with water under agitation, to a concentration of 67-72% sulfuric acid. During the dilution, which is a highly exothermic process, the temperature must not be allowed to rise above 155° F. (70° C.) in order to avoid darkening of the product.

Following dilution, the mixture is then pumped to an insulated acid-separating tank 14, where it stands for 2-3 hrs. without agitation. During this period the more dense 70% sulfuric acid settles to the bottom of the tank and the sulfonic acid forms a top layer. Under the conditions of concentration, temperature, and time given above, the separation is sharp. A settling time longer than 2-3 hrs. will increase the degree of separation, but tends to produce a darker product than is desirable. The final sulfuric acid layer is drawn off into an open funnel drain until the darker and considerably more viscous sulfonic acid appears at the outlet pipe discharge.

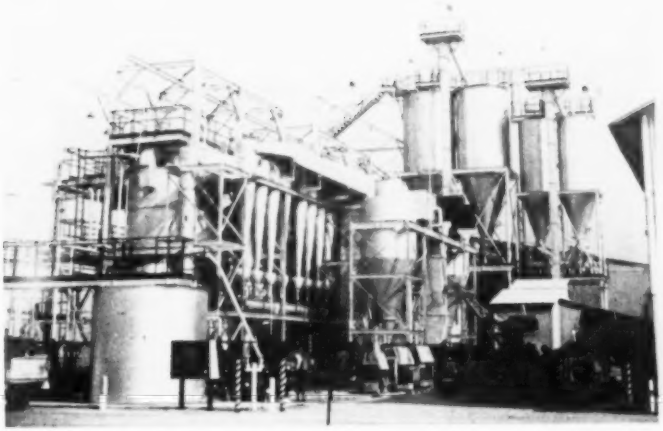
Neutralization

The next step in the manufacturing process is the neutralization of the sulfonic acid and residual sulfuric acid to obtain the sodium salt of each. The sodium salt of the sulfonic acid is the active base of the synthetic detergent.

The caustic-soda solution is generally used at a concentration of 20-30%. It is therefore necessary, if the caustic as purchased is a 50% or 70% solution, to dilute with water to the proper neutralizing strength.

The total amount of 50% caustic-soda solution required for neutralization is pumped from storage 1 to a measuring tank 9 above the neutralizer 15. All but a small amount of the quantity of caustic-soda solution, calculated from titration, is then run into the neutralizer. The withholding of a small amount allows for final adjustment to the desired pH.

The composition of the neutralized sulfonic-acid mixture, in the form of a white or egg-shell colored slurry bleached to that condition if necessary, will approximate 45% of solids and 55% of water. Of the solids, about 85% is the active alkyl aryl sodium sulfonate, 13% is sodium sulfate, and 2% is unreacted alkylate (free oil).



ALKYL-ARYL SULFONATE drying unit in syndet plant of Oronite Chemical Co. at Richmond refinery of Standard Oil Co. of California

Building

The treatment of the slurry after neutralization, whereby various detergency-promoting materials are added, gives the built product. The builders, such as additional sulfate, polyphosphates, and carboxymethyl-cellulose, are added in appropriate amounts so that the solids present in the slurry after building are in the proportion desired in the finished product.

The slurry in the neutralizer, containing the alkyl aryl sodium sulfonic and sodium sulfate in suspension, is at a temperature of 130-140° F. (54-60° C.) after neutralization.

The builders, in powder or granular form, are added directly to the neutralized sulfonic slurry with violent agitation within the body of fluid to obtain maximum dispersion and solution of the solids. Care should be taken to avoid beating air into the liquid since troublesome foaming will result. The temperature of the slurry during building is maintained at 130°-140° F. (54-60° C.), by the addition of live steam if necessary. As the viscosity of the slurry increases due to the addition of the builders, hot water is added, so that the concentration of solids in the completely built slurry is 35-45% by weight for a drum-dried product or 50-60% for a spray-dried product. The slurry exhibits a considerable degree of thixotropy, so that, under turbulent conditions of flow such as during agitation and pumping, and especially at temperatures as high as 130°-140° F. (54-60° C.), the operating viscosity is not above 3,500 centipoises and the slurry will flow readily.

Drying

The final step in the manufacturing procedure is the production of dry detergent. A spray dryer or a drum dryer is used, the choice depending largely on the market which the plant serves. For an industrial market or where shipment of finished product over long distances is necessary, bulk density is an important factor and the preference is for the somewhat more expensive drum dryer. This type produces a flake or powder of high density. For the household market, on the other hand,

where product appeal and rapid solubility are of paramount importance, the lower-cost spray dryer, producing a relatively light, fluffy, bead-shaped particle, is chosen. The usual range of bulk densities obtained for a spray-dried alkyl aryl sulfonate detergent is 15-22 lbs./cu.ft. whereas the same product drum dried will range from 40-45 lbs./cu.ft.

The formulation chosen as fairly typical of a heavy-duty household detergent is as follows:

Ingredients	% by Weight
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Nonionic Detergents

Practically all of the better known nonionic detergents depend on a polyoxyethylene chain for the polar portion of their molecules. The hydrocarbon section is frequently an alkyl substituted phenol. Polyoxyethylene ethers of alkyl phenols are analogous to alkyl aryl sulfonates with the polyoxyethylene chain taking the place of the sulfonate group. Another type produced by a single manufacturer has a straight-chain mercaptan from petroleum sources reacted to a polyoxyethylene chain.

Phenol is ordinarily synthesized from petroleum today. The polyoxyethylene group is built up from ethylene oxide molecules and the ethylene oxide in turn is derived from petroleum. The alkyl side chain is usually derived from petroleum. Thus, this type of detergent is based entirely upon petroleum as a raw material. In the past, nonionic detergents have had a rather limited market. However, during the last year or two there has been a very marked growth of interest in nonionic detergents of this type and the market appears to be expanding very rapidly.

Like the alkyl aryl sulfonates, nonionic agents possess certain advantages and disadvantages:

Advantages

1. They afford an excellent means of obtaining highly concentrated active agent.

2. Being liquids, their incorporation into a medium is not difficult.

3. They show less substantivity to fabrics than anion-active agents.

Therefore they can be used at low er concentrations, especially on wool en and silks.

Disadvantages

1. They remove oils from the skin very effectively, leaving the skin dry and uncomfortable.

2. They do not form as copious or stable a foam as the anion-active detergents. Thus some re-education of the consumer public would be required. However, certain nonionics which are especially poor in foaming power are useful on that very account in automatic washing machines and mechanical dishwashers where copious foam is undesirable.

3. Because of their liquid form they create special problems in formulating dry or powdered products.

The nonionics, when properly used, offer exceptional efficiency in washing operations. Further they are highly flexible. Because the polar group can be built up step by step to any desired degree, it is possible to tailor-make a large variety of nonionics for special purposes. This is not so easy with the anionics where the polar group consists of a single radical and is present on an all-or-nothing basis. Thus for an alkyl aryl sulfonate we must have at least one sulfonate group, but two sulfonate groups are entirely too much for ordinary purposes. However, with a nonionic of the type described we can have 6,7,8,9, etc. oxyethylene groups in the chain, varying the solubility, wetting power, specific detergent effects, etc.

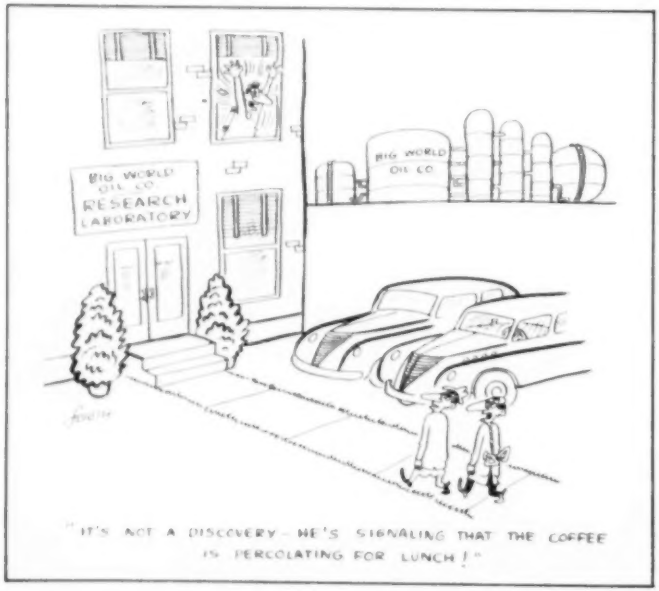
It is anticipated that alkyl aryl polyoxyethylene ethers will acquire an increasing share of the detergent market during the next several years and may become serious competitors of the alkyl aryl sulfonates.

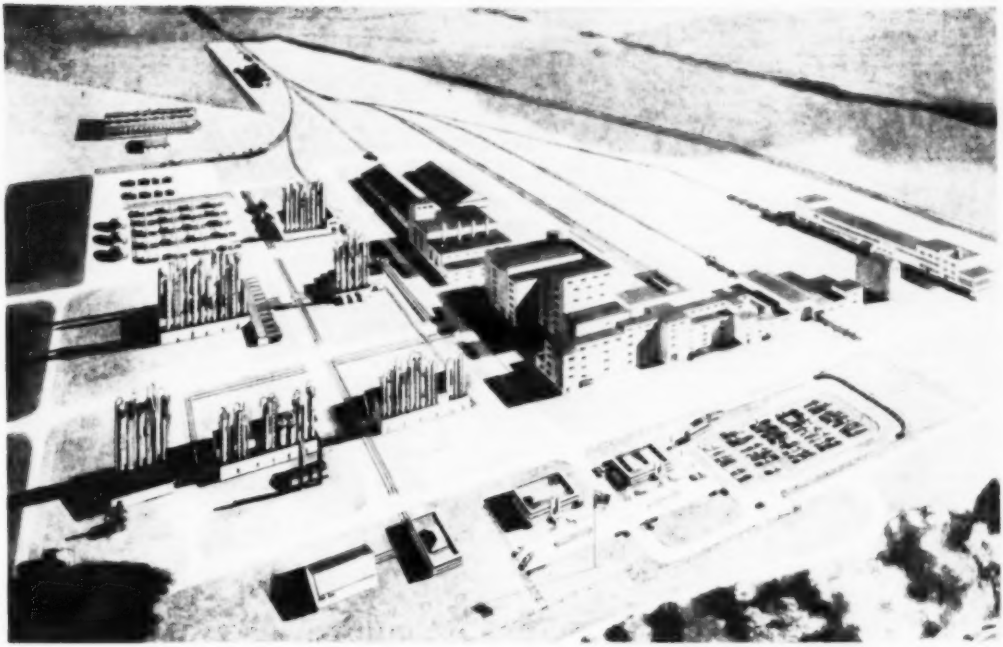
An interesting modification of this type of agent is the sulfated nonionic. This is made by attaching a fairly short polyoxyethylene chain to an alkylated phenol, then sulfating to attach a sulfate group via an ester linkage to the terminal hydroxyl in the polyoxyethylene chain. Such detergents retain many of the virtues of the nonionics while avoiding some of their disadvantages. For example, they are good foamers. Here again is a type of detergent based almost entirely upon petroleum raw materials which seems to have a good future.

Another type of nonionic detergent should be mentioned—that made by reacting ethylene oxide with tall oil. Tall oil is a rather impure mixture of fatty and rosin acids derived from pine wood during sulfate pulp manufacture. It is quite low in price and of limited value as a source of fats or oils for normal use. The use of this derivative has been moderately successful in the laundry.

Much research continues in the field of syndets. Nonionics will continue to be improved in terms of detergent properties as related to cost. More effective combinations of ingredients may be found, both of syndets themselves, and of builders for syndets. For example, potassium tripolyphosphate has been suggested as a builder for nonionics.

As now produced, the alkyl sulfates are more soluble and are preferable for use on the skin, in comparison with alkyl aryl sulfonates. If relatively pure fatty alcohols for sulfation could be produced from petroleum hydrocarbons, with a straight chain-length of C_{12} to C_{18} with the hydroxyl group on a terminal carbon atom, and at a cost competitive with alkylate, a new era would dawn in the detergent industry. What a challenge to the petroleum chemist!


BIG WORLD OIL CO.
RESEARCH LABORATORY
BIG WORLD OIL CO.
"IT'S NOT A DISCOVERY - HE'S SIGNALING THAT THE COFFEE IS PERCOLATING FOR LUNCH!"



PETROCHEMICAL AND TEXTILE FIBER PLANT shown here in artist's sketch of Canadian Chemical Co. Ltd.'s $50 million project, now under construction at Edmonton, Alberta. Completion is scheduled by winter '52.

Petrochemicals for Canada

Celanese affiliate builds new Edmonton plant with know-how obtained from Bishop plant's operations

*By DAVID R. KECK**
Canadian Chemical Co., Ltd.
Edmonton, Alberta

A PETROCHEMICAL plant, costing in excess of $50 million, is now being built by Canadian Chemical Co. Ltd., on a 130-acre site at Edmonton, Alberta. Canadian Chemical, an affiliate of Celanese Corp. of America, plans to begin operations in the fourth quarter of 1952.

Some of the chemicals to be manufactured — pentaerythritol, methanol, propylene glycol, dipropylene glycol, n-propanol and n-propyl acetate — have never before been produced in Canada. Other products to be produced in volume include acetone, acetaldehyde, acetic acid, formaldehyde and n-butanol.

With huge industrial expansion taking place in Canada, Celanese officials recognized that a two-fold purpose could be served by building the petrochemical plant at Edmonton: 1) production of a number of basic organic chemicals would have broad application in defense and peacetime economies and would contribute to the industrial self-sufficiency of Canada; 2) the plant would utilize a portion of the cellulose from another Celanese affiliate, Columbia Cellulose Co. Ltd. in British Columbia, to provide a large percentage of the cellulose acetate requirements of both the textile and plastics industries of Canada.

The Canadian Government shared this opinion and the decision was made to construct a plant to produce 25 million lbs. yr. of cellulose acetate flake, and considerable quantities of organic chemicals.

The Edmonton process is the same as that used at Celanese's Bishop, Tex., plant, with modifications where necessary. Feed stock to the plant comes from two sources, liquefied butane and propane from gasoline plants, and recovered gases from Edmonton refineries. Since a sweet feed is required, an H$_2$S removal unit is being provided for treating the refinery gas streams prior to their being fed into the oxidation unit.

Employ Partial Oxidation

The hydrocarbons in the feed are converted to oxygenated chemicals by partial oxidation with air under carefully controlled conditions of temperature, pressure, and reaction composition. Products which can be recovered in substantial quantities in the oxidation reaction are formaldehyde, acetaldehyde, propionaldehyde, acrolein, propylene oxide, methanol, acetone, and mixtures of heavier aldehydes, oxides, alcohols, and ketone.

Some of the formaldehyde will be marketed as 37% formalin solution. The remainder will be reacted with acetaldehyde to make pentaerythritol. Acetaldehyde will be available for sales, but the majority will be further oxidized with air to form acetic acid.

Acetic acid production capacity will

*From a talk delivered by Mr. Keck, on March 2, 1952, before the Canadian Chemical Group in Hamilton, Ontario.

be sufficient to supply considerable quantities to the Canadian market, as well as providing amounts needed for cellulose acetate manufacture. Upon being fed to the cellulose acetate plant, acetic acid is first converted to acetic anhydride, which is reacted with digested wood pulp or cotton linters to form cellulose acetate. The type of cellulose used is determined by the properties desired in the finished cellulose acetate.

Propionaldehyde and acrolein will be reacted with pure hydrogen to form n-propanol. A hydrogen unit is being built to supply the necessary hydrogen. Methanol and acetone are to be purified from the primary oxidation product; propylene oxide is to be hydrolyzed to propylene glycol and dipropylene glycol, and all are to be available for sales. A utility distillation unit will be installed to recover such compounds as butyl alcohols, and to react acids and alcohols to form a number of esters.

Equivalent to Six City Blocks

The petrochemical portion of the plant is being laid out in six areas, each approximately the size of a city block with streets completely surrounding each block. This type of layout is being employed to facilitate changes to any kind of equipment which might be desired. Our action results from experience at the Bishop plant, where no more than 10% of the fractionating towers are performing the same service as they did in the original plant installation.

Due to severe climatic conditions, the plant will be almost entirely housed. Only the fractionating towers, above a height of about 16 ft., will be exposed. The tower sheds will also house the tower reboilers. The main buildings will have two floors. The ground floor will contain pumps, pipelines, control rooms, tool rooms, offices, unit laboratories, and locker rooms. The second floor will house heat exchanger equipment and small tanks. Product surge tanks will be horizontal cylindrical tanks whose ends will project into sheds along the sides of the buildings opposite the towers. Product transfer pumps are to be located in these sheds.

The first of the areas will contain the feed sweetening unit and the hydrogen plant. The second of the areas is occupied by the primary oxidation unit. The main chemical stream from the oxidation unit is pumped to the products purification unit which is the largest unit in the plant. It contains about 25 towers and extractors. Straight distillation, azeotropic distillation, extractive distillation and liquid-liquid extraction are employed in this unit to make the desired cut between the products of the complex feed mixture. This unit also includes the propylene glycol and hydrogenation equipment.

Approximately 60 distillation towers will be installed in the petrochemical portion of the plant. In early operation of our Bishop plant, considerable difficulty was encountered in the operation of fractionation towers on compounds with which most of us had had no previous experience. Considerable increases in the capacities of these towers were achieved by rearranging flow patterns and blanking bubble caps according to published procedures. We were not, however, completely sure of some of the calculation methods for predicting performances of bubble trays. For this reason we installed a 6½ ft. diameter experimental tray, equipped with an 800-gpm. pump, and a 16,000-scfm. air blower. Data obtained on this experimental unit checked quite closely with other recently published material. With this information on bubble trays available it was suggested that a sieve tray or perforated tray be installed in our experimental unit for comparison with the bubble tray operation.

After a search of the published data on sieve trays, the hole pattern was decided upon and the tray was fabricated. It was immediately obvious that the operation of this tray was very superior to that of the experimental bubble tray. As soon as sufficient information was obtained to justify a plant installation, management agreed to the installation of sieve trays in a 6-ft. diameter, 60 tray tower, which was being added to the purification unit at that time.

All experimental data were obtained on air and water. The first objective, therefore, of a plant scale installation was a study of sieve tray efficiency as compared to bubble tray efficiency. Two alcohols with known relative volatilities were selected for the comparison. An idle 2 ft. diameter bubble tray column was operated concurrently with the sieve tray column for the study.

Sieve Tray Efficiency High

The study revealed two things. First, that the sieve tray efficiency was approximately 20% above that of the bubble tray; and second, that the efficiency of the sieve tray did not vary over the experimental range covered as the operating load in the column changed. Unfortunately the boiling range of the test mixture, n-propanol-secondary butanol, was higher than the design liquid and it was impossible to run the sieve tray column up to maximum capacity due to limitations in reboiler capacity. Those familiar with bubble tray efficiencies are aware, of course, that bubble tray efficiencies are low at low throughputs, rise to a maximum, and then fall off again at high throughputs. After these data were obtained, the 60-sieve tray tower was put in service and has operated satisfactorily for about two years now.

Some additional advantages of the sieve tray column are its simpler construction and consequently lower cost, its easier maintenance and its higher capacity. We feel that sieve trays as we design them offer about 15 to 20% higher capacity than a bubble tray of the same diameter. The absence of hydraulic gradient on sieve trays is one of the reasons for their greater throughput.

One would think that from the preceding description that sieve trays are the answer to all our woes. However, certain limitations make it necessary for us to use bubble trays in some cases. These are high vacuum and distillation cases, under extreme foaming conditions. In order to get good distribution of the vapors through holes in the trays it is necessary that at least 2 in. of liquid pressure drop be maintained on all sieve trays. For this reason its use is limited in vacuum service.

Small Holes Give Better Contact

If one were to set out to make foam, one would employ a large number of small holes with vapors passing through the holes as in a fritted gas tube. While our holes are larger than those in a fritted gas tube, the principle is the same. We feel that the extreme number of small holes in the sieve tray is the contributing factor to its higher efficiency since the objective in a fractionating tower is to get intimate contact of the vapors and liquids. We use ⅛ in. thick carbon steel plate and ⅛ in. diameter holes. We are now operating about six sieve trays at Bishop with diameters up to 8 ft. The new Celanese plant at Pampa, Tex., will be predominantly sieve tray tower. About three-fourths of our towers at Edmonton will have sieve trays.

In the preceding presentation of operating processes, liquid-liquid extraction was mentioned. It was noted early in our operations that low extraction efficiencies were being provided by our conventional ring and disc trays. Data were available which indicated that some people were employing perforated trays of various kinds for contacting the two liquid phases in liquid-liquid extraction. Since we had no specific data, a pilot plant was constructed in which perforated trays were installed inside of glass bell and spigot pipe. Preliminary information obtained on this 2 in. column were used to design a 6 in. diameter glass column. Data obtained on the larger column were sufficiently encouraging to warrant the installation of the perforated tray in all of our new and most of our existing liquid-liquid extractors.

Tray Construction

The construction of the tray is as follows: downcomers or upcomers, depending upon the direction of the flow of the continuous medium are installed similar to downcomers in fractionating columns. With the continuous phase flowing down the column, the dispersed phase collects beneath the tray where it is forced up through the holes into the continuous medium at a velocity above the streaming velocity, but a velocity slow enough to permit individual droplets of uniform size to form as the liquid passes into the continuous phase above.

Bypasses are provided for any emulsion which builds up between the phases or in case the flow of the dispersed phase exceeds the capacity of the trays. It was interesting to note that for a given height extractor about 50% more extraction stages can be installed, using the sieve tray as compared to the ring and disc.

Early installations of sieve trays were made by using drilled trays, however, the drilling cost for each succeeding installation was about 50% higher, and it is now the practice to buy mechanically perforated trays. If excessive holes are present in any portion of the tower these holes are blanked off by tack welding thin strips of the same kind of material over the excess holes.

This program fits in well with our standardization program within the plant since it permits all sieve trays for a given tower diameter to be perforated to the same pattern and the exact number of holes to be provided by blanking off.

Other Improvements

Another improvement included at the Edmonton plant is the use of thermo-siphon reboilers. The normal practice for years past has been to use kettle type reboilers, which are small tanks with tube bundles inserted in one end for heating the liquid flowing from the base of the tower. In the kettle type reboiler the liquid from the base of the tower flows around the outside of the steam heated tubes and only the vapor required to supply the demands of the column leaves the reboiler and flows back to the tower.

The thermo-siphon reboiler, as we employ it, has tubes either 5 ft. or 6-2/3 ft. long, so that three or four tubes can be cut from a standard 20-ft. length of tubing. The steam flows around the outside of the tubes while liquid enters the vertical tubes from the bottom and flows up through the tube. As the liquid flows up the tube a portion of it vaporizes, lowering the density of the liquid inside the tube to such a point that an extremely high velocity results, with the corresponding increase in heat transfer coefficient.

We have one operating reboiler of this type which operates with an overall heat transfer coefficient of 800 Btu/hr./sq. ft./° F. Except for high vacuum service we normally use an overall heat transfer coefficient of 500 for design purposes with a maximum heat flux of 50,000 Btu/hr./sq. ft. To date we have installed approximately 10 thermo-siphon reboilers at the Bishop plant and have so far succeeded in having them all too big. Since the above design method is not very scientific, a pilot unit has been installed and data are currently being obtained on a variety of products which will permit us to design these reboilers on a sounder basis. However, we feel that our present basis is sound enough for their installation at Edmonton, since the square feet required per bundle is only about half of that which would be required in the conventional kettle type reboiler.

In the sizing of thermo-siphon reboilers we have selected about five or six standard sizes, and these are constructed such that either the tube bundle alone or the entire unit is completely interchangeable with most of the other units of similar size in the plant. With this in mind, we will be able to stock spare reboilers which will fit in many places. As a point of general interest, with the short length of the tubes used in this type reboiler, we do not find it necessary to use expansion joints or floating tube sheets to take care of thermal expansion of the unit.

As a matter of fact we do not use floating tube sheets in any of our heat exchangers, since unequal expansion of the bolts and floating head flanges can result in minute leaks which would contaminate our products, most of which have impurities limited to a few parts per million.

Pumps Standardized

Another feature of our Edmonton plant is the standardization of pumps. Excluding special pumps for extremely large quantities or extremely high heads, there are very few different pumps within our plant. For example, in the cast iron and steel line there are no more than six different sizes of pumps and most parts of these are completely interchangeable with each other.

While some efficiency is sacrificed by this method of pump selection, the investment for spare parts and warehouse space is kept at a minimum. Further, by the purchase of large numbers of pumps of exactly the same description, a considerable price advantage is obtained from the manufacturer. Each pump installed is to be so mounted that the largest size motor demanded by that pump can be mounted under any conditions. With this type of installation we will have the utmost flexibility in our pump equipment.

Standardization of the instrumentation of the plant is being carried out as far as possible and instruments are being purchased on blanket order in the same manner as such equipment as valves and pipe fittings. Thus, any instrument received will be suitable for installation any place in the plant and will not receive a tag number or name until it is actually installed.

Ample Storage Provided

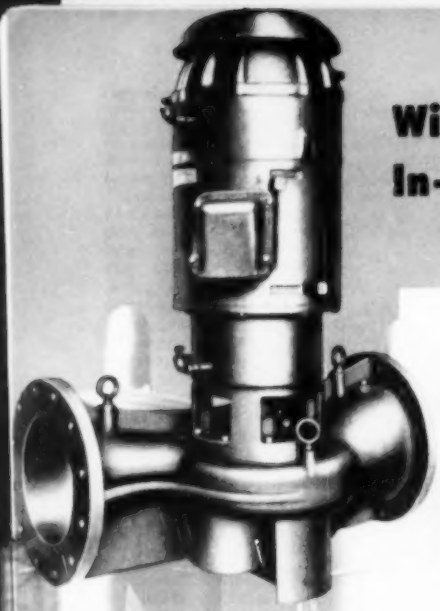
Products produced in the Edmonton plant will be shipped by rail. All liquid products will be handled either in drums or tank cars, while solid products will be shipped in box cars. A considerable storage capacity is being provided for each product to permit steady operation of the plant should delays in tank car movements to or from distant points cause erratic shipping schedules.

Production is expected to start in the last quarter of this year. The feed sweetening unit and hydrogen plant are being supplied by the Girdler Corp. of Louisville, Ky., while the remainder of the plant is being built by Brown & Root, Inc., Houston.

Meet the Author

David R. Keck graduated from The Rice Institute of Houston, Tex., in 1939 with a B. S. degree in chemical engineering. After six years with the technical service division of Humble Oil & Refining Co.'s Baytown refinery, he joined Celanese at Bishop in the spring of 1945 at the start-up of the plant. His experience with Celanese has been in operations, process, and project engineering.

At present Mr. Keck is project engineer for the petrochemical section of the Edmonton plant, and will be transferred to Edmonton as the plant process engineer.



Wilson-Snyder
In-Line, Vertical Centrifugal Pumps

for BOOSTING PRESSURES

right in the line

This type of single-stage, single-suction, close-coupled centrifugal pump can be installed in the line at any desired point without foundations.

Suction and discharge nozzles are on the same centerline and will fit existing line sizes from 4" to 20".

Their compact, in-line design with low NPSH requirements, as well as their adaptability to remote control, makes pumps of this type highly suitable for such applications as:

- √ **TRANSFER SERVICES** of all types throughout refineries and tank farms.
- √ **TERMINAL LOADING** and unloading services.
- √ **BOOSTING LINE PRESSURES** to meet suction requirements of main pumps.

Standard models in these pumps will handle liquids up to 300°F and can be furnished for capacities from 50 to 8,000 GPM and differential pressures up to 185 feet. Higher temperature liquids can be handled by specially modified models.

REFER . . . your special-application pump problems to "Oilwell" for tailored-for-the-job engineering. "Oilwell" sales representatives everywhere will gladly help you GET THE FACTS.

OIL WELL SUPPLY
DIVISION
UNITED STATES STEEL COMPANY

Executive Office—DALLAS, TEXAS
Export Office—
30 ROCKEFELLER PLAZA
NEW YORK 20, N. Y.

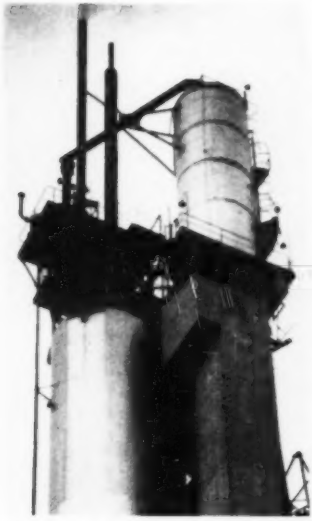
Area Offices — CALGARY, CANADA
CASPER, WYOMING COLUMBUS, O.
DALLAS, TEXAS HOUSTON, TEXAS
TULSA, OKLA. LOS ANGELES, CALIF.

Branches Serving All Oil Fields

USS

"OILWELL"
TRADE MARK

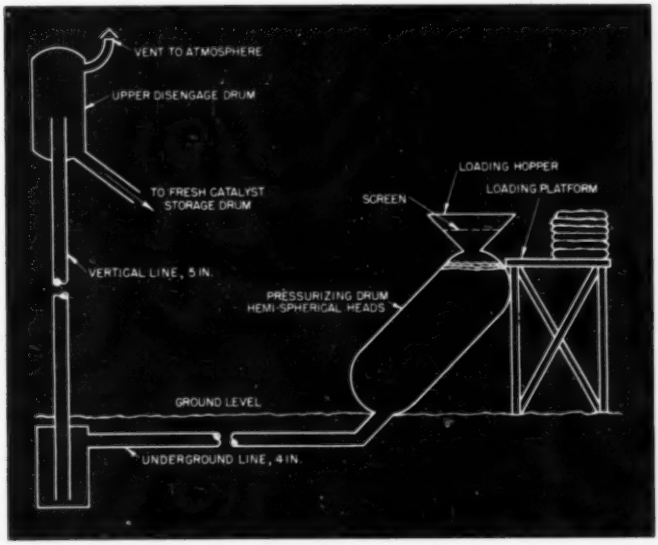
UNITED STATES STEEL



IT GOES UP HERE Slender line attached to side of storage drum carries catalyst up to disengager

IT GOES IN HERE Catalyst is loaded from bags into pressurizing drum for transfer to storage bin on cracking unit

Catalyst Is Blown to Hopper At a Neat 175 lb./min. Clip

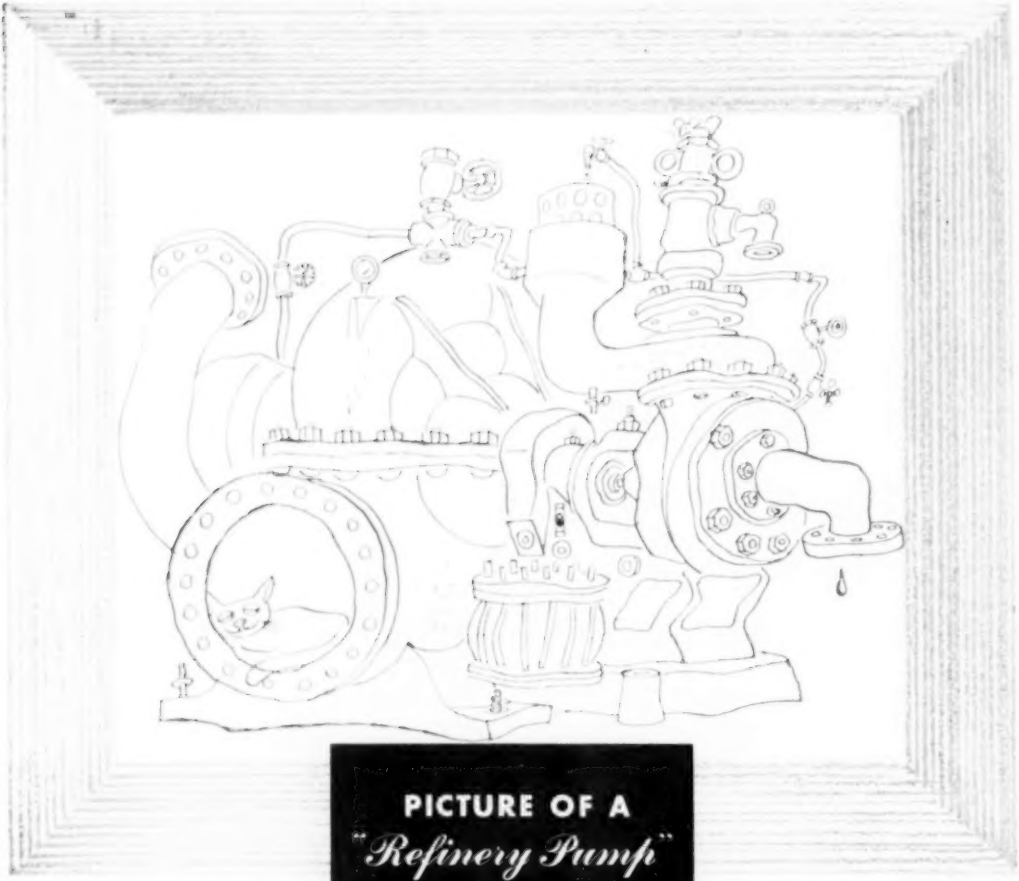


PNEUMATIC CATALYST CONVEYOR system shown schematically

LOW pressure compressed air serves as a helpful and rapid catalyst conveyor, from stock or incoming box car direct to the fresh catalyst storage drum on the Houdriflow cracking unit at Salt Lake Refining Co.'s plant at Salt Lake City, Utah.

The conveying system is shown in the sketch and photographs. Operation is as follows: The loading drum is filled with bulk catalyst by emptying bags through the filling hopper. It takes about 25 70-lb. bags. The ball valve is closed and the drum is then pressurized with plant air to not over 25 psi. In about 10 to 12 minutes the entire load of some 1750 lbs. of catalyst has been transferred

SCREENED OPENING in loading hopper at the pressurizing drum



PICTURE OF A "*Refinery Pump*"

"Refinery" pump? There ain't no such animal. But if one pump could be all things to all processes, it *might* look like this. Fact is, however, that in refining *it's pretty important to have each pump fitted to its specialized job.* No *one* answer is good for all.

That's why Byron Jackson builds job-engineered pumps. With a BJ you're sure of a pump that sizes up to the need and is pin-point engineered to profitable performance. Starting with more than 25 basic BJ pump designs used in the refinery field, BJ engineers can incorporate features to meet particular pressure, temperature, corrosive, material or power requirements.

When you need a pump for your refinery operation – check with BJ first!

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

SEE **BJ** FOR THE ENGINEERED ANSWER TO YOUR PUMPING PROBLEMS

through the 4-in. underground and the 5-in. upright lines to the fresh catalyst storage bin on the cracking unit.

The company has found attrition and breakage is negligible and the unique material handling system operates satisfactorily in every way.

How to Keep Propane Dry While Loading Tank Cars

A SHOP-FABRICATED drier, using a bed of activated alumina, eliminates all traces of moisture in propane being transferred from storage to the loading rack line at the Gregg-Tex Gasoline Corp. plant in Longview, Texas.

It will handle 120,000 gals. of propane (12 tank cars) before any trace of moisture shows on the tester. The alumina bed is reactivated after use each day for four hours, using hot residue gas at a rate of 14 mcf. hr.

The drier unit itself is located in the 3-in. loading line between pump and rack. It consists of a 10-ft. length of 14-in. standard line pipe, set up vertically on the ground, with a hemispherical bottom and a 14-in. flange and blind for the cover on top. Inlet (at the top) and outlet (at the bottom) are in the sidewall and are made of pipe and 3-in. flanges. A 4-in. clean-out opening is provided at the bottom of the column, also a 1-in. drain line.

An 8-ft. bed of alumina is held between two pieces of ¼-in. perforated steel plate, 14-in. in diameter welded inside the column. Reactivation of the alumina is handled by sending gas from the plant gas intake scrubber through a small steam heater to the drying unit and return to the intake scrubber, via a 1-in. line.

The data given is based on the July 1951 Operating Report issued by the Refrigeration Operating Group of the Natural Gasoline Assn. of America. Tyler, Texas, by Robert Lasley, station maintenance, Gregg-Tex Gasoline Co., Longview, Texas.

CASH for your Ideas!

Want cold, hard cash for your own maintenance ideas? PETROLEUM PROCESSING will pay at regular space rates (or more if your idea is a really hot one). So why not take a look around the shops or refinery. Then send in your stuff to us, along with illustrations, etc. Don't worry about the appearance; we'll dress up the drawings. Send contributions to:

Plant Practices Editor
PETROLEUM PROCESSING
1213 West Third St.
Cleveland 13, Ohio

WHENEVER YOU SEE

furnaces like these,

you can be sure

they're* PETRO-CHEM ISO-FLOW *design

More than **1000** *are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petro-Chem Iso-Flow furnaces are pre-eminently satisfactory.*

PETRO-CHEM ISO-FLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INCORPORATED

122 EAST 42ND STREET, NEW YORK 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston · Flagg, Brockett & Durgin, Boston · D. D. Foster, Pittsburgh · Faville-Levally, Chicago · Lester Oberholtz, California · Gordon D. Hardin, Louisville, Kentucky

(To obtain more data on advertised products see page 1032)

Precision

uring years of Safety Head Development, S&B has accumulated the largest selection f thin ductile metals in the world. These etals are controlled within .0001 of an inch ith rupture pressures ranging from 5 to ,000 PSI.

Precision

Thousands of BS&B Safety Heads are watch-dogging the safety of major industries all over America. Users are assured that the latest techniques and the best materials are used in manufacturing BS&B Safety Heads ... because development specialists carry on a continuous experimental program.

Precision

Testing, by actual rupture tests, is thorough. After any given lot of BS&B Safety Head discs have been fabricated, one out of 6 discs is selected at random and tested to destruction. Each one tested must break within 5%, plus or minus, of the rated pressure or the entire lot is discarded.

Making Sentinels of Safety...

BS&B SAFETY HEADS

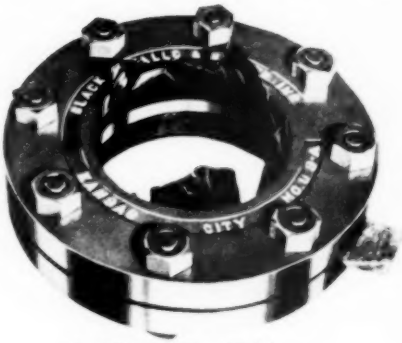
Sudden overpressure . . . and an expensive pressure vessel or piece of processing equipment is damaged – perhaps beyond repair. If that's all you're lucky. Other equipment may be lost, too... still worse, people may have been injured critically, often fatally.

A BS&B Safety Head, sentinel of safety, is designed to prevent just these things.

The Safety Head is your partner in protection. BS&B Safety Heads insure instant pressure relief when relief is most needed to save property and lives. They can be used as both primary and secondary relief devices.

There is always the possibility that other safety devices may fail... because of corrosion, clogging, or due to chemical reactions of the material handled in the vessel or line. Eliminate the gamble – with BS&B Safety Heads.

Regardless of your pressure application – air, gas or liquid – bland or corrosive, BS&B has the code-accepted Safety Head for you. Get the facts, get safety, get a BS&B Safety Head. Write for catalog giving complete details.



In Oil and Gas Fields...

On Pipe Lines... Around Refineries...

BS&B Safety Heads are a common sight in the oil industry. Small in comparison with other equipment, they become conspicuous only during an emergency they help keep under control. Behind BS&B is 60 years of experience in manufacturing equipment for the oil industry. BS&B knows pressure vessels and lines and how to put controlled safety into them with the right BS&B Safety Head. You'll find them on oil and gas separators, gas scrubbers, emulsion treaters, storage tanks, heat exchangers, shells, refining pressure vessels, natural gas pipe lines, compressor lines and in condensate recovery-pressure maintenance plants.

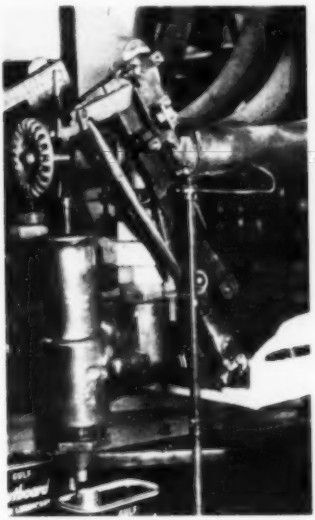
SAFETY BS&B HEADS

BLACK, SIVALLS & BRYSON, INC.

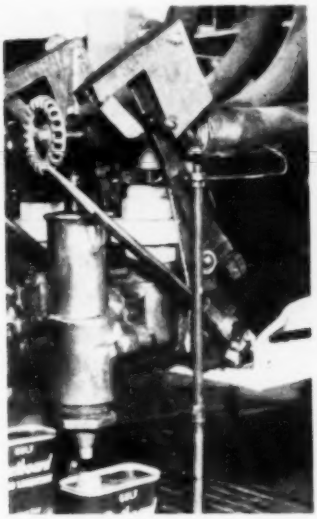
Dept. 2D7

7500 East 12th Street

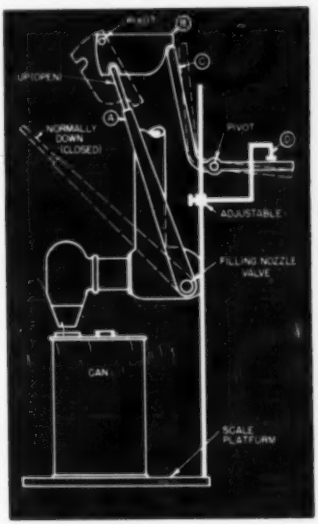
Kansas City 3, Missouri



CAN FILLING valve handle held open by catch



CAN IS FULL trip has released valve handle



HOW IT WORKS see text for fuller explanation

Can Filler Can't Fail with Mechanical Trip

THE package department at Gulf Oil Corp.'s Philadelphia refinery uses a number of automatic cut-off devices on its small container filling machines. The mechanism on the can filler had been actuated by a battery-powered solenoid trip on the quick-acting valve of the filling nozzle. However, because of occasional battery failure, the device began to give trouble.

The solution was to convert from electric power to a mechanical trip as shown in the drawing and photographs. Dotted lines in the drawing indicate the positions of the various parts of the device when the can is full. In operation, the can is placed on the scale platform under the nozzle, and the valve is opened by lifting the valve handle *A* to the upper position so that its tip is held by the slot in the pivoted piece *B*, which in turn is held in a horizontal position by trigger lever *C*.

When the container is filled to its predetermined weight, the scale platform naturally drops down a fraction of an inch. This moves arm *D* down against the lever *C*, releasing pivoted piece *B* and in turn releasing valve handle *A*, closing the filling nozzle valve. The height of arm *D* is adjustable on the vertical rod that is attached to the scale platform.

In making the change, part of the existing solenoid equipment had simply been discarded where it actuated lever arm *C*. Pivoted pieces *B* and *C* were retained. The set-up was adapted from a similar installation at Gulf's Staten Island refinery.

How to Reduce Cat Cracker Noise

By E. D. MATTIX and C. A. BRODINE*

TWO positive profits have been obtained by an installation to reduce the noise level of the catalytic cracking units at the Lake Charles, La., refinery of Cities Service Refining Corp. They are increased capacity and a definite reduction in the noise level; it is now possible to hold a conversation at the base of the flue gas stack.

The solution to the problem of reducing the noise level first in with a second problem, which was that of automatically controlling the regenerator pressure. The excessive noise on the original installation was caused by high velocities due to a 6 psi. pressure drop in the stack, divided into three steps: 1) the original butterfly valve, 2 psi.; 2) the conventional orifice plate, 1 psi., and 3) a new Chapman slide valve, 3 psi.

The new slide valve was manufactured with two slides on opposite sides of the body; one to be operated manually and the other automatically by a pressure controller.

Instead of operating the slide valve with one of several conventional hydraulic valve positioners with a piston as a motor, it was decided to try a reversible rotary air motor mounted directly to the handwheel shaft. The air motor is regulated by a conventional null-balance control valve positioner that operates on an air pilot valve controlling the 50 psi. air supply to the motor. This system has the following advantages: it eliminates the fire hazard from hydraulic fluids, and also the maintenance of a separate system because the air supply is already available where pneumatic control is used.

The installation has been justified on the basis that the regenerator could be run at 0.5 psi. higher pressure if it could be automatically controlled. The 0.5 psi. increase in pressure calculated to a 2% increase in regenerator capacity due to decreased gas velocities at higher pressures.

* Mr. Mattix is technical assistant to the operating superintendent and Mr. Brodine is instrument foreman, Cities Service Refining Corp., Lake Charles, La., refinery.

The above article is based on information contained in a paper, "Refinery Control Problems," presented by Mr. Mattix at the Instrument Conference, Houston, Texas, Sept., 1951.

For **ALL** *Gasolines Requiring Blue Dye*

High tinctorial strength of **DU PONT OIL BLUE A** helps keep engine intake system deposits at a minimum

DU PONT OIL BLUE A is available for use in both aviation and motor gasolines. This single component dye dissolves rapidly in gasoline and other petroleum fractions. It can easily be added in concentrated solutions with proportioning equipment, or directly by means of a "dye pot."

Because of high tinctorial strength, it can be used in economically lower concentrations to achieve any required color intensity. This quality also helps keep engine intake system deposits at a minimum.

Due to its many desirable characteristics, Oil Blue A is used to color Du Pont Tetraethyl Lead Compound—Aviation Mix, where it provides a base for all three standard aviation gasoline colors. Why not ask your Du Pont Petroleum Chemicals Division representative for a sample?

SOLUBILITY—The solubility characteristics of Oil Blue A in gasolines will vary according to their composition. However, the following guide for approximate solubilities in typical gasoline components may be helpful:

APPROXIMATE SOLUBILITY . . . . Grams/100 U. S. Gal.	
Straight Run Gasoline	760-950
Thermal Cracked Gasoline	1150-1500
Aviation Gasoline	570-760
Benzene	28400-32000

DUPONT
Better Things for Better Living ... through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.

By Peter J. Gaylor, Patent Attorney, Gaylor, Cifelli & Jurick, Newark, N. J.

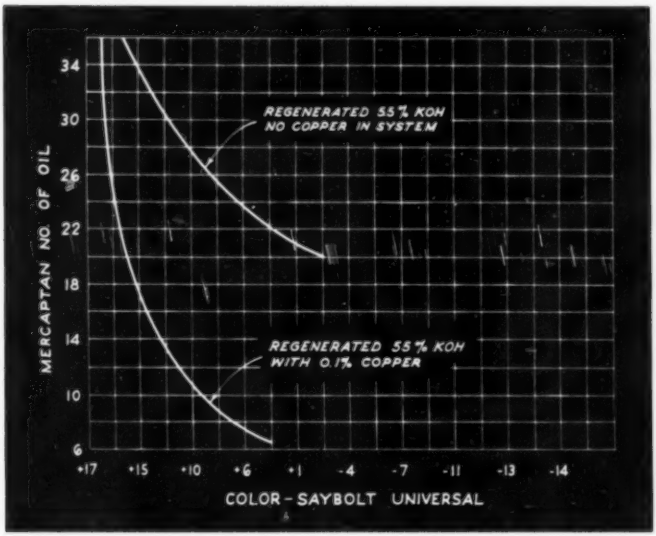


FIG. 1 Effect of copper catalyst on mercaptan removal in treated heavy oil (Standard Oil Co., Ind., U. S. 2,591,946)

Copper Catalysis in Mercaptan Removal

SEVERAL patents recently issued to Standard Oil Co. (Ind.) indicate considerable activity in simplification of copper sweetening.

In its U. S. patent 2,591,946, a process is described for removing mercaptans from sour fuel oil distillate, without formation of excessive color, by contacting the distillate with 1-15 vol. % of 50-60% of aqueous potassium hydroxide containing about 0.004-0.1% by weight of copper in the form of an active copper compound which is an active oxidation catalyst, and introducing an oxygen-containing gas in an amount sufficient to react with the mercaptans, and maintaining a temperature of 80°-125° F. during the contacting period.

Thereafter, the oil is water washed immediately and the KOH solution is regenerated by distillation at subatmospheric pressure and temperature not exceeding 300° F.

Under these conditions, the mercaptans are claimed to be converted to "colorless" disulfides without formation of objectionable color bodies. The copper compound, preferably $CuCl_2.2H_2O$, is added in the form of an aqueous solution into the caustic which is maintained hot enough so as to avoid formation of a black precipitate. In this way, a blue complex is formed in the form of a colloidal compound which does not precipitate out of the reagent. The treated oil contains a trace of copper (not over 1 ppm), but this is claimed to be readily offset by addition of 0.001-0.01% of a metal deactivator such as N,N'-di-salicylidine-1,2-diaminopropane.

Attempts to use the cheaper caustic soda for sweetening fuel oil distillates were unsuccessful. In comparison to NaOH solution, KOH gave a faster reaction and a sweet product before color formation developed. The cause of color formation is not fully understood, but it is believed to be due in part to the oxidation of phenolic substances contained in high sulfur oils. The effect is apparent from Fig. 1, which shows results obtained by treating a sour West Texas heater oil with 1% by volume of KOH solution at 120° F. and air at the rate of 1.85 cu. ft./hr. The upper curve shows rapid formation of color (decrease in Saybolt Universal color value) as the mercaptan number of the oil is reduced when treated with air and regenerated 55% KOH. The lower curve illustrates the improved results with the same KOH solution containing 0.1% $CuCl_2.2H_2O$. Maximum oxidation rate occurred with a copper concentration of 0.1-0.2% $CuCl_2.2H_2O$.

If air is employed in the oxidation, it is preferably used at about 100 psig pressure, whereas oxygen may be used at atmospheric pressure. The odor of the treated oil has been found to be satisfactory for marketing requirements if the oxidation is carried to a point where the mercaptan number is below 5.

In its U. S. Patent 2,593,464, the company points out that metal deactivators have been relatively ineffective in stabilizing color in conventionally copper-treated heavy oils. It has found, however, that copper fluoride supported on an inert carrier containing at least a minimum amount of water (about 8%) can be used to sweeten sour oils when the treating is carried out at a temperature in excess of 190° F. in presence of free oxygen. The life of the catalyst can be extended by introducing oxygen or a free-oxygen containing gas into the oil before the oil contacts the catalyst. It is claimed that the process degrades the initial color of the oil only slightly and produces a color stable oil without the use of an added copper metal deactivator.

The process is claimed to be applicable to any hydrocarbon oil containing mercaptans. Sweetening cannot be obtained with copper fluoride in the absence of water which is added to the catalyst present in the weight ratio between 12:1 and 3:1 of inert adsorbent material and copper fluoride. Treating temperature is 200°-220° F., and the preferred treating mass contains 60-75 weight per cent adsorbent, 5-20% copper fluoride and 20% water.

Stabilizer for Alumina Base Dehydrogenation Catalysts

ALUMINA appears to be the universally preferred base for dehydrogenation catalysts. They all, of course, suffer in becoming gradually poisoned during the conversion operation by a carbonaceous coating formed on the catalyst surface. This is removed by the regeneration procedure, involving burning off of the coating with air. There is some activity lost during each calcination period.

In its U. S. Patent 2,592,765, Universal Oil Products Co. discloses that during calcination at, e.g., 1100° F. (600° C.), most alumina catalysts exhibit good stability and retain their gamma-aluminum structure. However, upon heating at 1100°-1575° F. (770°-860° C.), an alumina-molybdena catalyst undergoes appreciable degradation, apparently resulting in

NOW STANDARDIZED

3 Precision Controls for All Speed Problems

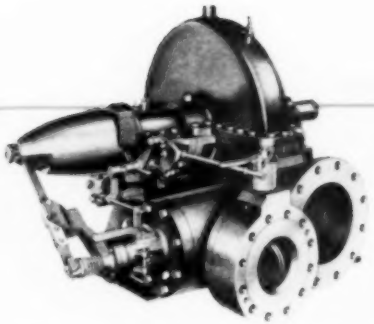
Here's governor standardization that "pays off". Now you can economically solve all speed-control problems with only three basic governors.

Costly special engineering is eliminated. Advanced design gives an unusual degree of flexibility . . . with precise speed control for all steam conditions. Results? Initial costs are lower . . . shipments are quicker . . . spare-parts inventory is reduced.

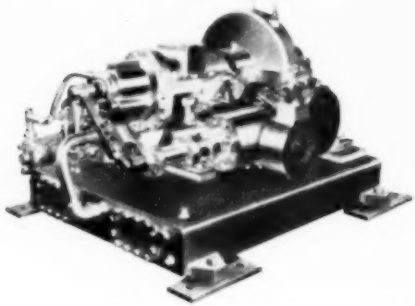
Designs for three basic classes of steam conditions, three wheel sizes, and three types of governors provide, in effect, twenty-seven standard variations to cover a wide range of applications. All oil-governed, direct-connected Type E units include the standard reservoir-type base, as illustrated. What's more, Type E governors can meet a great number of special requirements with optional accessories. This standardization results directly from Westinghouse's wide experience in all industry.

Other outstanding maintenance-saving features on the Type E turbine are Dual Protection . . . Weather Protection . . . Centerline Support . . . and a Rugged Governor Housing. Ratings are available from 5 to 1,500 hp.

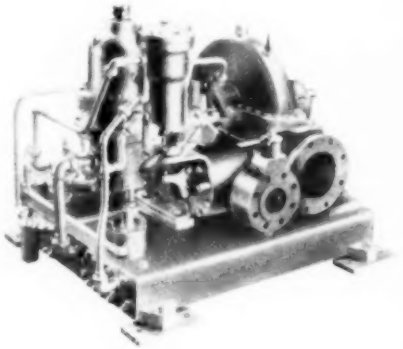
For complete information ask your nearby Westinghouse representative for Type E Turbine Book J50527, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.



Shaft-Type Governor. For narrow speed-range applications, this governor automatically positions the steam admission valve to control turbine speed within close limits—*6 to 8% speed regulation.*



Hydraulic-Orifice Governor. For wide speed-range applications such as drives for fans, blowers, and compressors —*3-to-1 speed-adjustment range; 6% speed regulation.*



Vertical Oil-Relay Governor. For narrow-range precision-control applications such as drives for generators, pumps, blowers and compressors—*33⅓% speed-adjustment range; 4% speed regulation.*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Turbines

J-50527

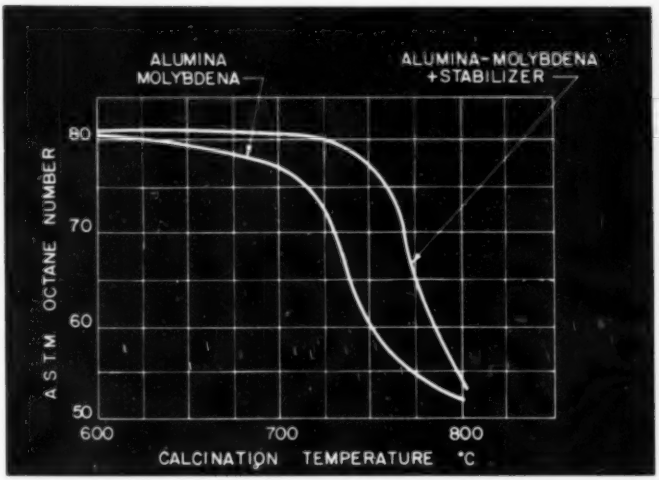


FIG. 2. Effect of stabilizer in alumina-molybdena catalyst on octane number of reformate (UOP, U. S. 2,592,765)

formation of a crystalline complex substance.

It has been found that the addition of 5-30% of kaolin or montmorillonite clay to the alumina-molybdena mixture stabilizes it and prevents formation of a crystalline complex, resulting in increased thermal stability of the catalyst and a relatively increased octane number in the reformed or dehydrogenated naphtha.

This is apparent from Fig. 2, which shows the higher octane numbers obtained with a catalyst containing 50-90% alumina and 4-20% molybdena stabilized with 5-30% of montmorillonite, compared with the unstabilized catalyst.

The same effect is obtained when other oxides of metals of Groups V and VI are employed, such as chromia, instead of molybdena.

Now Possible to Reactivate "Dead" Cracking Catalysts

ACCORDING to a patent issued to Gulf Research and Development Co. (U. S. 2,579,123), it is possible to reactivate permanently deactivated silica-alumina cracking catalysts by impregnating the surface with a fluid compound yielding silica upon decomposition, and decomposing the impregnated compound.

Such catalysts are generally temporarily deactivated by a deposition of "coke" which is burned off during the regeneration cycle. However, over a long period of reuse, (say about 18 months), a permanent deactivation takes place. To replace the material in a fixed-bed unit is an expensive operation since a shut-down is required.

According to the patent, it is possible to reactivate such permanently deactivated catalysts in situ by impregnating them with a material such as alkyl silicates, silicones, silicon tetrachloride, etc. and decomposing the silicon compound at 1040° F. to produce a coating of silicon dioxide upon the catalyst surface.

A surprising discovery reported is that the activity of the reactivated catalysts can be adjusted in the direction of a more valuable product distribution by heating the reactivated catalysts at 1200-1500° F. for several hours, or better, 10-40 hours. Such a treatment not only increases the gasoline-gas plus coke ratio but also often increases the actual gasoline yield.

One example describes such a reactivation with tetraethyl orthosilicate solution to give a 13.9% silica deposit. One volume of 37.4° API Pennsylvania gas oil boiling at 458-676° F. when passed over a volume of such catalyst for one hour at 811° F. gave a gasoline yield of 30.1 vol.% of charge, while the gas plus coke yield was 12.8%, compared with 21.4% and 9.7%, respectively, for the permanently deactivated catalyst.

U. S. 1,579,133 covers a similar catalyst regeneration with boria.

Sweetening Gasoline with Alkali-Saturated Charcoal

FOR best removal of mercaptans from gasoline by use of caustic soda, it is desirable to treat the gasoline with mercaptide-free caustic. Obviously, it would be impractical to use fresh caustic all of the time, so

WEATHERCOAT is specified by leading refinery designs engineers.*

WEATHERCOAT is the standard for maintenance in leading refineries.*

Make these tests:

- Troweling Ease—Cold
- Flexibility with Toughness
- Freedom from Shrinkage
- Mixes with Sand for Scratch Coat (or buy ready-mixed MASTIC WEATHERCOAT)

Send for information. Prove to yourself that WEATHERCOAT gives the best yield and is the easiest to apply.

*Names on request.

AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH ST., SAN FRANCISCO 4, CALIF.

Providence 14, R. I. · Perth Amboy, N. J. · Baltimore 3, Md. · Columbus 15, Ohio · Mobile, Ala. · Tucson, Ariz. · Seattle, Wash. · St. Louis 17, Mo. · Baton Rouge 2, La. · Inglewood, Calif. · Oakland 1, Calif. · Portland 7, Ore. · Washington 6, D. C. · San Juan 23, P. R.

(To obtain more data on advertised products see page 1032)

...A COMPLETE LINE

KROMIK*

The multiple-pigment metal primer that penetrates to protect against rust, corrosion, abrasion and weather. Combines the best protective properties of red lead with three other protective agents for far tougher, longer lasting service. Covers evenly, whether brushed or sprayed.

SILVERBRITE* ALUMINUM No. 15

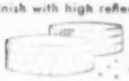
A superior ready-mixed aluminum paint for general interior and exterior use. Has consistently good performance. Widely used on tanks and other structures where good reflection is important.

KEM LUSTRAL*

The multi-purpose synthetic industrial enamel. Has excellent resistance to oil, gasoline, grease, abrasion, sunlight, hydrocarbons. Meets a wide variety of application conditions. Kem Lustral is ideal for general purpose use, for pipeline identification, etc.—interior or exterior.

KEM* TANK WHITE

A brilliant white, self-cleaning, fume-resisting finish with high reflectivity to reduce evaporation.



METALASTIC*

A long-lasting finish for tanks and structural steel, with the weather-resisting properties of carbon and graphite. Provides a film that's tough and elastic. Fast drying.

KEM A & A RESISTING ENAMEL

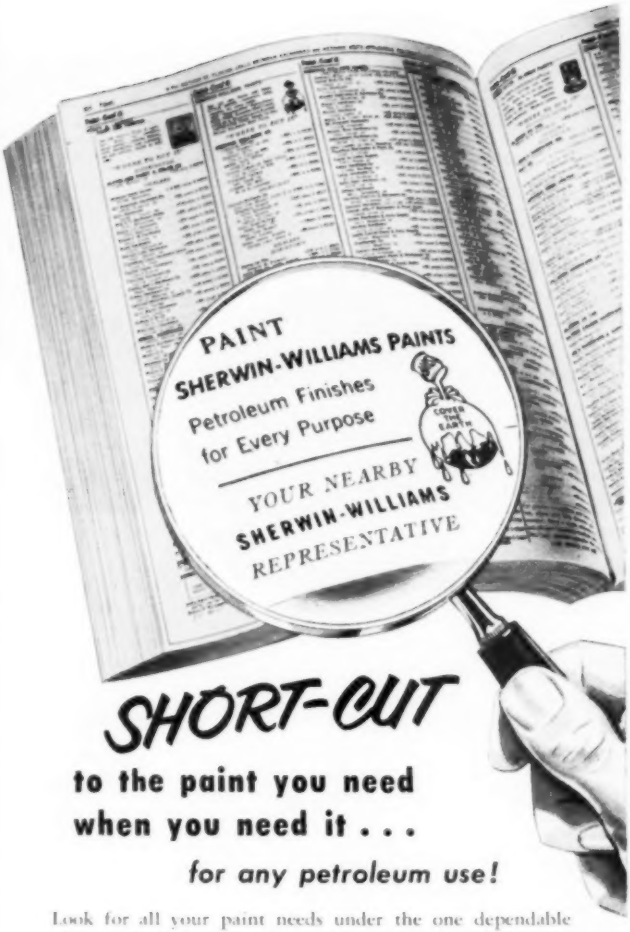
Designed for maximum resistance to acids, alkalies, and moisture. Primarily intended for interior use.

GAS & FUME-RESISTING PAINT

A special formula for finishing exterior or interior wood or metal surfaces where hydrogen sulphide and similar gases are present. Meets the difficult painting conditions common in such locations.

PETROSEAL INTERIOR TANK COATING

A heavy-bodied elastic coating for tanks, tank cars and tankers. Positively non-soluble in naphtha, gasoline, kerosene or crude oil. Withstands contraction, expansion, vibration. Will not become brittle or crack.



SHORT-CUT

to the paint you need when you need it . . .

for any petroleum use!

Look for all your paint needs under the one dependable Sherwin-Williams label! From the *complete* line of Sherwin-Williams Petroleum Finishes you can get specially engineered answers to *all* of your paint problems . . . from drilling rig to marketing equipment. It's your assurance of finishes that keep application costs down, that cut over-all costs because they stay on the job longer.

Listed at the left are a few of the principal types of Sherwin-Williams Petroleum Finishes in wide use today, and proved, on the job, in thousands of field applications. Get full details on these and other finish types from your nearby Sherwin-Williams representative. He's as handy as your telephone. Or write The Sherwin-Williams Co., Transportation Division, Cleveland 1, Ohio.

SHERWIN-WILLIAMS

COVER THE EARTH

that regeneration must be resorted to.

Regeneration of spent caustic by oxidation is not a simple process. According to Standard Oil Co. of Ohio's U. S. Patent 2,577,824, uncatalyzed regeneration of spent caustic solutions with air has not resulted in sufficient regeneration unless high temperatures are used, and this causes extensive damage to operating equipment. Catalysts have been used, but precise control is required in order to properly protect the catalyst, which is difficult to achieve in commercial practice, and regeneration is generally carried out short of completion so that the caustic does not have the full mercaptan absorbing capacity when reused.

In this patent, a process is disclosed which is claimed to increase utilization of the caustic tenfold, and produce distillates having much lower mercaptan content. This process involves contacting the sour gasoline with charcoal of about 10-20 mesh, saturated with an aqueous caustic soda solution of preferably 20% strength. The contacting is done in a tower at a rate of 1-10 volumes of hydrocarbon per volume of adsorbent per hour. If desired, caustic solution may be present in the tower. A temperature of 50–225° F. is employed.

Of the examples given, most of them employ gasolines containing added synthetic mercaptans. However, one example does employ an untreated sour gasoline originally containing 0.015% total mercaptan sulfur. This was treated with a bed of charcoal pieces saturated with 20% aqueous caustic plus unabsorbed 20% caustic solution in an amount of 1 volume per 3 volumes of charcoal. The treated gasoline had a mercaptan content of .002%, which value was maintained until 150 volumes of hydrocarbon per volume of adsorbent had been treated.

Patents Issued in May

The following classified listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazettes of the U. S. Patent Office for May 6, 13, 20 and 27, 1952. Vol. 658, Nos. 1-4.

PROCESSES

Catalyst

PETRONATE* (Oil Soluble)

PYRONATE* (Water Soluble)

HYPONATE* (Oil Free)

PETROLEUM SULFONATES

. . . made to your specifications for use in products such as . . .

- ✔ *rust preventive formulations*
- ✔ *soluble cutting oils*
- ✔ *soluble textile oils*
- ✔ *emulsion degreasing compounds*
- ✔ *fuel oil additives*
- ✔ *emulsifiers for agricultural and insecticide sprays*
- ✔ *special emulsifying formulations*

Ask Sonneborn about PETRONATE, the oil soluble petroleum sulfonate available in various molecular weights; HYPONATE, an oil free petroleum sulfonate; and PYRONATE, a water soluble petroleum sulfonate effective as an emulsion breaking reagent.

Sonneborn petroleum sulfonates—superior in quality and possessing exceptional uniformity—are now made to fit a wide variety of specific needs. They can also be tailor-made to your exact specifications. You can rely upon prompt shipment.

* Reg. U. S. Pat. Off.

White Oil, Petrolatum & Sulfonate Division

L. SONNEBORN SONS, Inc.

300 Fourth Avenue

New York, N. Y.

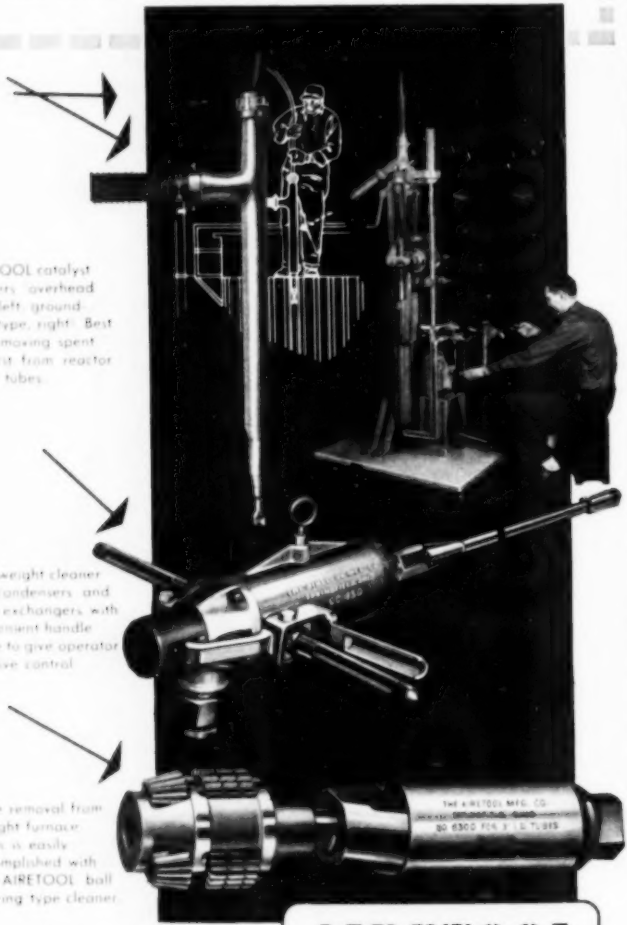
Achieved by Sonneborn RESEARCH

(To obtain more data on advertised products see page 1032)

PRODUCTIVE refineries depend on AIRETOOL tube cleaners!

It's a fact that America's foremost refineries—refineries that insist on the most efficient equipment available—overwhelmingly favor AIRETOOL tube cleaners. Below are listed just a few of the many available for tough tube cleaning jobs.

Write The AIRETOOL Mfg. Co., 336 S. Center St., Springfield, Ohio, for complete details.



AIRETOOL catalyst cleaners: overhead type, left; ground-level type, right. Best for removing spent catalyst from reactor tower tubes.

Lightweight cleaner for condensers and heat exchangers with convenient handle valve to give operator positive control.

Coke removal from straight furnace tubes is easily accomplished with this AIRETOOL ball bearing type cleaner.

SEE OUR CATALOG in the REFINERY CATALOG

BRANCH OFFICES: New York, Philadelphia, Chicago, Tulsa, Baton Rouge, Houston

REPRESENTATIVES in principal cities of the U.S.A., Canada, Mexico, South America and England.

AIRETOOL MANUFACTURING COMPANY SPRINGFIELD, OHIO

There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

Patents

2,599,497 (Universal Oil Products Co.) Process of strengthening a calcined supported phosphoric acid catalyst.

2,599,498 (Universal Oil Products Co.) Supported phosphoric acid catalyst and process of manufacture.

2,599,499 (Houdry Process Corp.) Drying a solid refractory hydrogel containing an alkali salt.

Conversions

2,599,224 (Houdry Process Corp.) Method and apparatus for processes employing fluent solids.

2,599,396 (Shell Development Co.) Method and apparatus for treating hydrocarbon oils with powdered catalyst.

2,599,910 (The Texas Co.) Underground liquefaction of coal by hydrogenation.

2,599,943 (Universal Oil Products Co.) Method of catalytically reforming hydrocarbons with platinum catalyst.

2,599,299 (Socony-Vacuum Oil Co.) Apparatus for conducting thermochemical conversions.

2,599,410 (Houdry Process Corp.) Apparatus for contacting solid materials with fluids.

2,599,744 (Sinclair Refining Co.) Catalyst regeneration in conversion system.

2,599,920 (Standard Oil Development Co.) Sour oil neutralization process.

2,599,932 (Universal Oil Products Co.) Production of alkyl-substituted hydrocarbons and isomerized hydrocarbons by catalytic dehydrogenation.

2,599,950 (Universal Oil Products Co.) Continuous conversion and coking of heavy liquid hydrocarbons.

2,599,999 (Sun Oil Co.) Catalyst treatment in catalytic cracking of hydrocarbon oil.

Hydrocarbon Synthesis

2,599,223 (M. W. Kellogg Co.) Separation of organic compounds obtained in hydrocarbon synthesis.

2,599,255 (Standard Oil Development Co.) Production of hydrocarbons from a granular solid reactant.

2,599,360 (M. W. Kellogg Co.) Separation of organic compounds made in hydrocarbon synthesis.

2,599,434 (M. W. Kellogg Co.) Synthesis of oxygen compounds by hydrogenating carbon oxides.

2,599,928 (Standard Oil Development Co.) Synthesis of oxygenated organic compounds by carbon oxide hydrogenation.

2,599,196 (Phillips Petroleum Co.) Process for use of spent Fischer Tropsch catalyst for manufacture of carbon monoxide-hydrogen synthesis gas.

2,599,201 (M. W. Kellogg Co.) Synthesis of organic compounds from carbon monoxide and hydrogen.

2,599,847 (M. W. Kellogg Co.) Hydrogenation of carbon monoxide with promoted iron catalyst.

Refining

2,599,258 (United States) Method and apparatus for treatment of gaseous hydrocarbon mixtures to remove nitrogen.

2,599,359 (Texas Development Corp.) Solvent separation of wax from hydrocarbon mixtures.

2,599,371 (Texas Development Corp.) Treating hydrocarbons with alkali metal hydride, the combining period initiated at sulfur inflection point.

2,599,511 (Shell Development Co.) Fractionation process for hydrocarbons using inert.

2,599,692 (Shell Development Co.) Method of absorbing gases including hydrogen sulfide.

2,599,942 (Socony-Vacuum Oil Co.) Purification of oils and waxes with bauxite.

2,597,261 (Signalite Corp.) Process for treating petroleum emulsions.

2,597,295 (Standard Oil Co., Ind.) Hydrocarbon oil upgrade stabilized against copper with chlorine.

2,597,827 (Pure Oil Co.) Preventing the development of sourness in certain petroleum oils during distillation by treating in presence of gaseous.

2,597,870 (Girbert & Barker Manufacturing Co.) Separation and removing water from gasoline.

2,599,211 (Universal Oil Products Co.) Treating hydrocarbon gases by scrubbing with distillate.

PRODUCTS

Chemicals

2,599,214 (Shell Development Co.) Polymers of ethyl vinyl carbinol.

15 YEARS LATER

Aerial view of Delaware River Bridge taken in the spring of 1952, showing the High Speed Rail Transit Lines on outer sides of bridge. Photo by Aero Service Corporation

...a report on the service of Everdur Electrical Conduit on the Delaware River Bridge

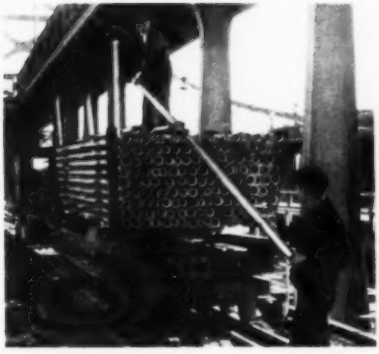
The Delaware River Bridge, linking Camden, N. J. with Philadelphia, opened to vehicular traffic in July 1926. In 1934-36, when the High Speed Rail Transit Line was installed, more than 200,000 pounds, or 14½ miles of Everdur* Conduit, in nominal sizes from 1½" to 4", was used for electrification and electro-pneumatic signal operations.

Service conditions were anything but good—and the problems encountered included corrosive industrial gases and almost continual vibration caused by the rapid transit rail cars and 70,000 motor vehicles a day.

Now, with another bridge expansion project planned, an engineer of The American Brass Company made an "on-location" inspection of the 15-year-old installation. The detailed report concludes as follows:

> *"It is my opinion that the corrosion rate of the unpainted Everdur Conduit installed on the Delaware River Bridge is very low, and that the conduit will last as long as the bridge itself."*

Everdur Electrical Conduit is made of Everdur Copper-Silicon Alloy in two wall thicknesses (R.C. and E.M.T.). Publication E-12 describes this ANACONDA Product in detail. For a copy, address The American Brass Company, General Offices, Waterbury 20, Connecticut.



In 1934, at the time of installation, the Transit Line rails were utilized to transport 20-foot lengths of Everdur Conduit to the entire network.

wherever corrosion resistance counts *consider*

EVERDUR ELECTRICAL CONDUIT

a product of

ANACONDA®

...for Dependable

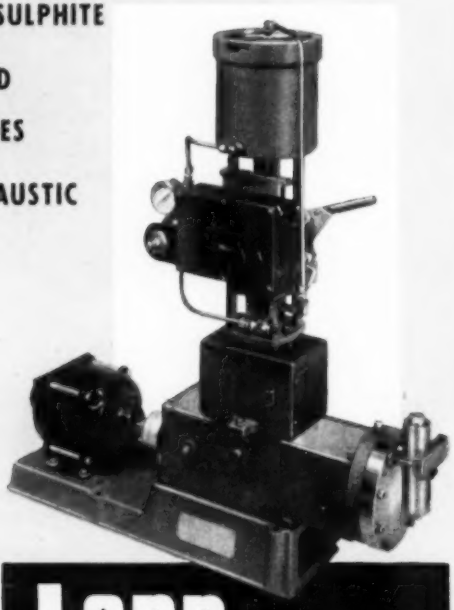
AUTOMATIC METERING

of CONCENTRATED SULPHURIC ACID

✓SODIUM SULPHITE

✓FILTER AID SLURRIES

✓LIQUID CAUSTIC



Lapp

Auto-Pneumatic

PULSAFEEDER

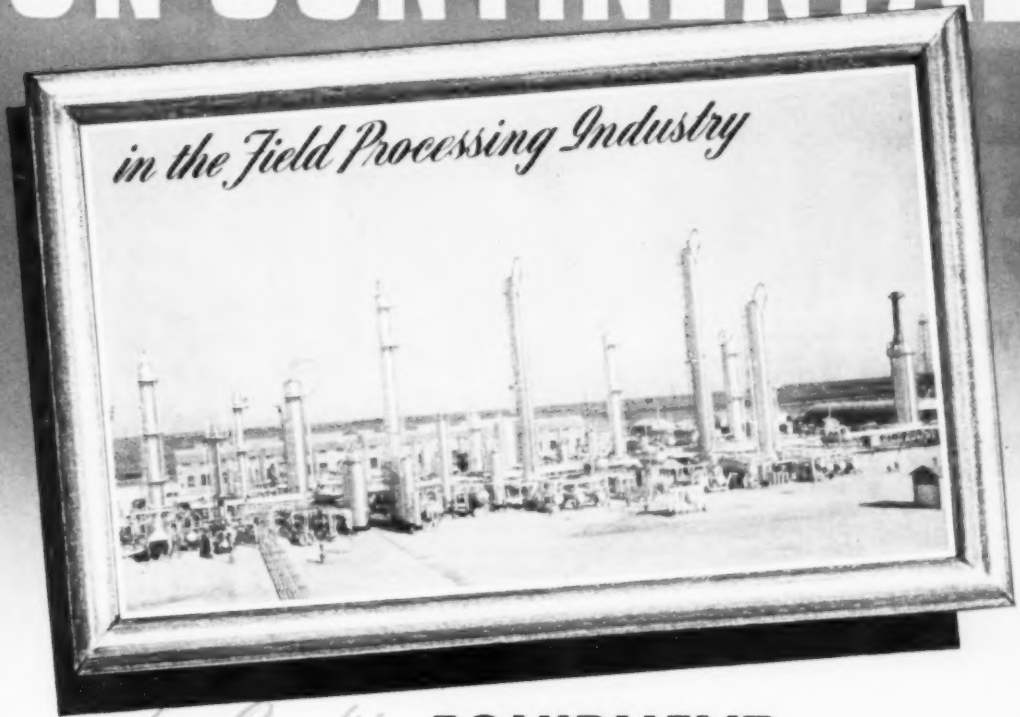
No stuffing boxes to leak . . . no small orifices to clog . . . positive displacement for true metering . . . construction of materials which withstand the corrosive action of chemicals involved. That's the Lapp Pulsafeeder, the up-to-the-minute instrument-controlled piston-diaphragm pump for controlled-volume pumping of hard-to-handle chemicals. Auto-Pneumatic Control responds to instrument air pressure to establish pumping rate, controlled by flow-orifice meters, flow-positive meters, pH controls, flow variable-pH variable combinations, or other control instruments.

NEW BULLETIN AVAILABLE. Write for Bulletin 300, just issued. 24 pages of description, specifications, typical applications, flow charts. Lapp Insulator Co., Inc., Process Equipment Division, 593 Maple Street, Le Roy, N. Y.

Patents

Fuels

YOU CAN COUNT ON CONTINENTAL



for Quality EQUIPMENT
DEPENDABLE Service

40 years of practical experience are behind Continental engineers and service specialists in every phase of the industry. You can count on their recommendations being sound and helpful.

CONTINENTAL

SERVING THE OIL AND GAS INDUSTRY

THE CONTINENTAL SUPPLY COMPANY, General Offices: DALLAS, TEXAS

Export Division: The Continental Supply Co., Inc., 30 Rockefeller Plaza, New York, N. Y.
The Continental Supply Company, 134-135 Salisbury House, London Wall, London E.C.2, England

The Continental Supply Company, Limited, 216 Lancaster Building, Calgary, Alberta

Representatives: ARGENTINA • BOLIVIA • BRAZIL • CHILE • COLOMBIA • ECUADOR • PERU • TRINIDAD • URUGUAY • VENEZUELA

TAKE NO CHANCES WITH SLIGHT LEAKAGE

APPLICATION: Where even slight leakage of a flowing medium might become obnoxious, dangerous or excessively expensive.

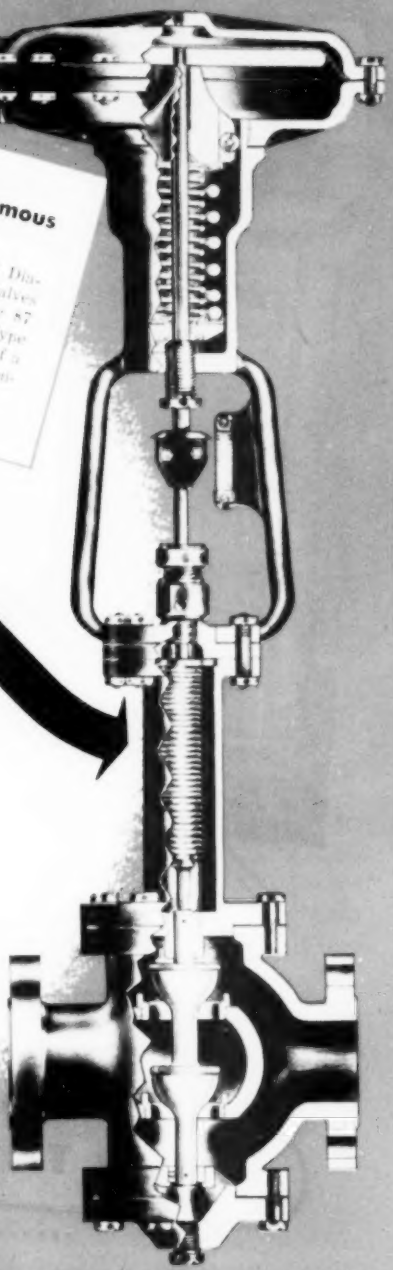
Specify

BS&B CLIMAX

Type 87 Diaphragm Control Valves

From The Famous Family

of Climax Type 86 Diaphragm Control Valves ... the NEW Type 87 ... identical to the Type 86 except for the use of a bellows seal plus a conventional stuffing box.



...with bellows sealed stem

Constantly striving to improve an already satisfactory item—that's part of the BS&B policy, part of our way of doing business. For example, take BS&B Climax Type 86 Diaphragm Control Valves of which the Type 87 is a family member. All Climax Type 87 valve bodies are designed to conform to I. S. A. tentative face-to-face standards. New designs continue to feature BS&B's interchangeability-of-parts advantage for greater operating and maintenance economy.

Type 87 is manufactured for all services and in all materials that are contemplated by Type 86 and in sizes from ½" to 6". Bellows can be supplied in bronze, stainless steel, Monel, Hastelloy "B", Nickel or other special alloys suitable. Maximum working pressure 300 lbs. cwp. The conventional teflon packed stuffing box is installed at the point the valve stem passes out of the bellows casing to forestall any appreciable loss of flowing medium in case of bellows failure.

Ask your BS&B MAN... 33 Branches...13 Sales Offices...Ask for New Climax Catalog Section 105 — recently revised — or write Black, Sivalls & Bryson, a leader for 60 years in oil and gas producing and refining equipment...out in front with controls and equipment for the processing industries.

CLIMAX BS&B CONTROLS

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division, Dept. 4-D7

7500 East 12th St. Kansas City 3, Missouri

Patents

2,566,765 (J. F. Pritchard & Co.) Method of extracting Btu content of natural gas.

2,567,754 (Ethyl Corp.) Manufacture of tetraethyllead.

2,567,755 (Commercial Solvents Corp.) Recovery of nitrated kerosene.

Lubricants

2,566,556-7 (Union Oil Co. of Calif.) Lubricating compositions containing metal soap complex.

2,566,619 (Standard Oil Development Co.) Lubricating oil additives comprising P,S reaction products of styrene-substituted copolymer.

2,567,918 (Merker & Stapleterry) Lubricant thickened with phthalocyanine.

2,567,945 (General Electric Co.) Lubricating oils containing perylenimide and substituted ester.

2,567,756 (Standard Oil Co., Ind.) Lubricant containing stabilized phosphites and sulfur-containing hydrocarbon reaction products and compositions containing the same.

Re. 23,862 (Iron Cutting Corp.) Copolymeric sulfonates.

2,567,811 (Cities Service Research and Development Co.) Purifying esters of fatty acids.

2,567,905 (California Research Corp.) Production of lubricating oils from chlorinated wax.

2,567,910 (California Research Corp.) Production of lubricating oil from chlorinated wax.

2,566,754 (Phillips Petroleum Co.) Process for making grease by cooling to fluidic gel stage.

Specialties

2,565,371 (Phillips Petroleum Co.) Insect repellent ointment comprising hydrogenated rotenone and 2-amino-2 methyl-1,3-propanediol.

2,566,273 (Cities Service Oil Co.) Method of inhibiting hydrogen sulfide corrosion of metals with reaction product of ethylene diamine and formaldehyde.

2,566,425 (Cities Service Oil Co.) Method of inhibiting hydrogen sulfide corrosion of metals with reaction product of ethanolamine and formaldehyde.

2,566,450 (Shell Development Co.) Corrosion inhibiting coating composition containing organic amine nitrites.

2,567,202-3 (Columbian Carbon Co.) Manufacture of carbon black.

2,566,213 (Petrolite Corporation, Ltd.) Process for preventing corrosion and corrosion inhibitors.

2,566,267 (Sun Oil Co.) Paper impregnating wax product and process for preparing the same.

Miscellaneous

2,565,344 (Standard Oil Co., Ind.) Grid seal for fluidized solids contacting systems.

2,565,945 (The Texas Co.) Automatic distillation testing.

2,566,020 (Phillips Petroleum Co.) Solvent extraction of vegetable oils.

2,566,095 (Houdry Process Corp.) Sublimation of minerals.

2,566,611 (Houdry Process Corp.) Chemical treatment of finely divided solids.

2,566,705 (Ernest J. Schlabitz) Process for the extraction of valuable constituents from oversized oil-bearing shales not used in solution.

EQUIPMENT

Processing, general

2,565,252 (United Engineers & Constructors, Inc.) Apparatus and method for the catalytic manufacture of carburetted water gas.

2,566,254 (Standard Oil Development Co.) Apparatus and process for circulating powdered solid in chemical treatment.

2,565,284 (United States of America as represented by the Secretary of the Interior) Apparatus and method for the treatment of gaseous hydrocarbon mixtures containing a substantial proportion of nitrogen as a diluent.

2,566,304, 5, and 6 (Claude R. Schneider) Bubble column designs.

2,566,240 (Frank J. Kerrigan) Bubble tray.

2,566,266 (Sperry Vacuum Oil Co., Inc.) Apparatus for conducting thermo-chemical processes in the presence of a moving bed of solid particles.

2,566,419 (Houdry Process Corp.) Apparatus for contacting solid materials with fluids.

2,566,436 (De Laval Separator Co.) System and method for separating solids from liquids.

YOU'RE kidding YOURSELF if you think every safety valve is equally safe.

We know of one case where inspection showed that 27 out of 36 safety valves were stuck tight–*would not have operated at pressures far above the set point*–yet the user of those valves *thought* he had protection. He *could* have been stuck right along with those 27 valves.

If you want 100 per cent safety–and you'd hardly want less–there's one sure way to get it–specify BalanSeal or FarriSeal Safety Valves.

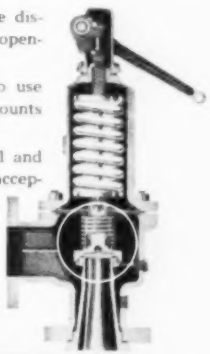
Why? Because they *can't* stick, plug or corrode. Critical working parts are permanently isolated from any contact whatever with the lading.

Because they're unaffected by back pressures in the discharge manifold due to its own operation or to the opening of other valves in the line.

Because these features make it possible for you to use smaller discharge piping, an economy which often amounts to substantially more than the cost of the valves.

You'll be interested in the engineering of BalanSeal and FarriSeal Valves–design which is rapidly gaining acceptance in hundreds of successful installations.

Ask for our "8-Minute Brief."



1189 R

Your Safety's REAL With FarriSeal

Farris ENGINEERING CORP.

438 COMMERCIAL AVE., PALISADES PARK, N. J.

AFFILIATES

Farris Stacon Corp. Temperature Regulators • Farris Flexible Valve Corp. Pinch Type
Farris Hydrotorque Corp. Remote Controls • Farris Hydroseal Corp. Elastic Piston Seals

(To obtain more data on advertised products see page 1032)

Controlled Pressure

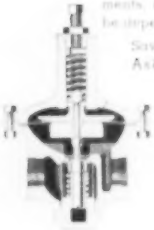
for efficient operation

Clark Pressure Reducing and Regulating Valves

are precision made for positive pressure control on air, gas or steam lines.

Where different types of equipment, with varying pressure requirements, are operated from a common line, Clark Regulating Valves can be depended on to deliver automatically the "just right" pressure to each.

Save on fuel, maintenance and protect expensive equipment. Ask your Clark representative to specify the right Clark valves for your needs . . . or write us direct.



TYPE KRV

Pressure Reducing Valve. Diaphragm Operated. Single Seated Valve. Sizes ¼" to 1½" for initial pressures up to 250 P.S.I. Reduced pressures to 85 P.S.I.

TYPE CRV

Pressure Reducing Valve. Integral pilot controlled piston operated. For pressure control from "dead end" to full capacity. Sizes ½" to 8".

TYPE ORV

Pressure Reducing Valve. ½" and ¾". Single Seated. Spring Loaded. Diaphragm Actuated. For initial pressures to 250 P.S.I. Reduced pressures to 200 P.S.I.

QUICK-CLEANING STRAINERS

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ¼" to 3". 1 P.S. For pressures to 250 P.S.I.

THE CLARK MANUFACTURING COMPANY

1830 East 38th St. • Cleveland 14, Ohio

Clark

THE HOME OF DUO STEP LEVERAGE

The complete line of dependable fluid controls

(To obtain more data on advertised products see page 1032)

Patents

Catalytic Reactors

Instruments

Valves & Fittings

Tools

Miscellaneous

How to Obtain Patents

Readers may obtain copies of any U. S. patent from the Patent Office at 25 cents each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.

Hobbyist Places Bones' Age At 3500 Yrs.

AN INDIAN MOUND was discovered underneath Shell Development's Emeryville, Calif., laboratories during recent excavation. **Stanley T. Abrams** (left), physicist in the instrumentation department, whose hobby is archaeology, paleontology and mineralology, has been studying some of the bones discovered there. He points out to his associate, **James R. Cook**, that their indicated age is about 3,500 years.

E. J. Fox has been appointed plant superintendent at Carbide and Carbon Chemicals Co.'s Texas City plant, succeeding **Harley M. Ross** who has been named assistant works manager for the company with headquarters in New York. **Robert Dillon** is the new assistant superintendent, replacing **Dr. C. M. Blair** in charge of chemical production units, chemical shipments, and works laboratory.

Dr. Blair has been named superintendent of the new chemicals plant to be built at Seadrift, Tex. He is a native Texan and attended University of Texas from which he received his Ph. D. in organic chemistry in 1933. His initial work with the company began in the research laboratory at South Charleston, W. Va., in 1934. When Carbide began operations at the Texas City plant in 1941, Dr. Blair moved there as assistant superintendent in charge of chemical manufacturing and the technical development laboratory. For the time being, he will remain in Texas City and will work on organizational details, and will move to Seadrift at a later date.

R. P. Barry, Jr., has been appointed assistant superintendent at Seadrift. Prior to this appointment he was area supervisor of chemical production at the company's South Charleston plant. He came to Carbide in 1936 upon graduation from Vanderbilt University with an M. S. in chemical engineering.

Blair and Barry were associated with ethylene oxide work at the company's first operation of this type in the 1930's in So. Charleston, W. Va., and will be re-united on the same type of work at the new Seadrift plant.

* * *

The New York section of the American Institute of Chemical Engineers has elected the following to office for the 1952-53 season: **Howard L. Malakoff**, Cities Service Research and Development Co., chairman; **Frank B. White**, Foster Wheeler Corp., vice-chairman; **C. J. Brown**, W. R. Grace & Co., secretary; **Max Strawn**, Foster Wheeler Corp., treasurer; **Richard F. Shaffer**, Pratt Institute, counselor-at-large.

* * *

Harvey S. Hicks has been named department manager, catalytic cracking, for Shell Oil Co. at Wilmington, Calif. He succeeds **J. D. Davis** who has left for the Norco refinery as manager of the new catalytic cracking unit to be constructed soon.

Mr. Hicks, formerly manager of effluent controls and the utilities department, joined Shell in 1934 as a draftsman at Martinez and was later transferred to the Wilmington refinery technological group.

* * *

Osgood V. Tracy has returned to his position as general manager of the chemical products department of Esso Standard Oil Co. after service as director of National Production Authority's Chemical Division. He is succeeded in the NPA post by **George E. Holbrook**, on leave as assistant director of the development department, E. I. Dupont deNemours Co. Inc. in Wilmington, Del.

* * *

Glenn A. White, operations manager of Shell Chemical's Martinez plant, has been appointed assistant superintendent of the Shell Chemical plant at Dominguez, Calif. Mr. White started with Shell in 1937 as a chemist at Shell Point.

* * *

Dr. R.B. Killingsworth has been appointed manager of the technical department of Vacuum Oil Co. Ltd., in London, England. He has been staff assistant in charge of special products at Socony-Vacuum's laboratories. The appointment is effective this month.

A native of Columbia, S. C., Dr. Killingsworth was graduated from the University of South Carolina. He received his Ph. D. in chemistry in 1937 from New York University where he was a teaching fellow. He then joined Socony-Vacuum's technical service department in Brooklyn and became assistant director in 1946. He was transferred to the

laboratories' headquarters in 1950 where he has been handling process products, asphalts, chemicals, and specialties.

* * *

Bruce K. Brown, deputy administrator of the Petroleum Administration for Defense for the past 19 months, has been reelected a director and president of Pan-Am Southern Corp. in New Orleans. Mr. Brown, who left the PAD post May 30, has reopened his residence in New Orleans and will continue to make his home in that city.

* * *

Three refinery employes of Esso Standard Oil Co. won a total of $2,010 for submitting suggestions in the company's "Coin Your Ideas" system. **Samuel F. Biscoe** of the Baltimore refinery received $1,000 for suggesting an improved method of producing roofers' flux, used in the manufacture of asphalt shingles. **Frederick W. Roth**, chief operator of the Baltimore plant's cracking coils, earned $575 for his idea to preheat heating oil feed with distillates in two units. **Angelo Calamito**, a foreman in Bayonne's yard department, was awarded $435 for suggesting an efficient and non-hazardous hot-water heater that could be incorporated into the operation of washing tanks.

* * *

Appointed to refinery manager posts with the British American Oil Co. Ltd. are **M. T. Stevens** to Clarkson, Ontario, **R. T. Watson** to Edmonton, Alberta, and **C. W. Coote** to the Calgary refinery.

Mr. Stevens

Mr. Watson

Mr. Coote

Mr. Stevens has managed B-A refineries at Moose Jaw, Calgary and Edmonton since joining the company in 1935. Mr. Watson has been associated with various B-A refineries across Canada during his 32 years in the company's manufacturing department. He leaves his post as manager of the Calgary refinery to accept his new appointment. Succeeding Mr. Watson at Calgary, Mr. Coote assumes his new post after serving the past four years in the capacity of assistant manager of the refinery. Taking over Mr. Coote's former position is **R. M. Donald**, a 17-year veteran with B-A.

* * *

William A. Williams, oil refining technologist, whose background includes 18 years experience in the Canadian petroleum industry, has been selected by Standard-Vacuum Oil Co. to direct its refining activities in India. He has been appointed chairman and managing director of a new subsidiary now being formed to build and operate Stanvac's new $35 million refinery at Bombay. He received his B. S. in mechanical engineering from the University of Michigan in 1934 and for the past two years has

YOU, TOO, CAN GET

More Throughput

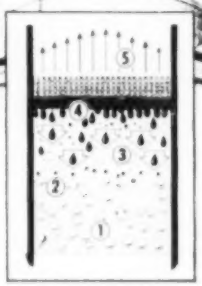
WITH METEX MIST ELIMINATORS

From the recovery of liquids entrained in discharge gases to the removal of contaminators to further processing, these simple knitted-wire pads are daily contributing to greater on-grade throughput, increased efficiency and lowered costs in refineries from coast to coast.

Metex Mist Eliminators do just one thing — remove liquids entrained in gases. The diagram shows how they are doing it in stills, towers, cats, knock-outs, evaporators and other vessels.

Efficiencies 95% and better • Little if any pressure drop • Easily installed in existing equipment • Made of practically any metal • No valves or moving parts to service.

Worth looking into, isn't it? For full information, write for free copy of "Metex Mist Eliminators," an 8 page brochure that's packed with facts.



HOW IT WORKS

(1) Gas passes through fixed, (2) Entraining mist bubbles combine into drops of liquid droplets. (3) Droplets are entrained in rising stream. (4) Droplets coalesce on knitted-wire surfaces to form large drops that fall back against the flow. (5) Gas passes on, freed from entrainment. The liquid is returned.

METAL TEXTILE CORPORATION

KNITTERS OF WIRE MESH FOR MORE THAN A QUARTER CENTURY

631 East First Avenue, Roselle, N. J.

been superintendent of Imperial Oil Ltd.'s Montreal refinery.

* * *

D. T. Shaw has been named manager of Atlantic Refining Co.'s Philadelphia refinery and **John S. Patchin** has been named assistant manager.

Mr. Shaw

Mr. Patchin

Mr. Shaw became associated with Atlantic in 1929 in the research and development department. In 1937 he was moved to the refinery and in 1945 was made assistant manager. A native of Oberlin, Mr. Shaw received an A. B. degree at Oberlin College in 1914, and an M. A. degree at Brown University in 1916.

Mr. Patchin has been superintendent of the refinery's mechanical department since 1950, and he has served in various supervisory capacities since he became affiliated with the company in 1920. He is a mechanical engineering graduate of New York University.

* * *

E. J. Martin has been promoted to the post of vice president and general manager of Sinclair Research Laboratories, Inc., at Harvey, Ill.

Mr. Martin

Mr. Martin joined the Sinclair staff in 1929 after completion of his chemical engineering training at the University of Michigan. After about four years in cracking work in the development department, he was assigned to Sinclair's Lube Research Division. There he rose to assistant director before being promoted to his recent administrative post.

Over the years he has been instrumental in planning Sinclair lubricating refining facilities and in the development of new lubricants for the expanding needs of the public, armed services, and industry. He developed a solvent refining process for the manufacture of extremely high viscosity lubricating oils and has been closely associated with the development of additive detergent oils since 1936.

* * *

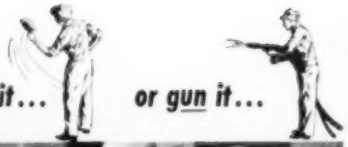
Alan K. Jeydel and **Michael J. Curry** have joined the product development department, Celanese Corp. of America, as product development engineers. **G. H. Wiech** joins the department in the capacity of technical service engineer. Mr. Jeydel was formerly with Pennsylvania Salt Manufacturing Co. He is a graduate of Rensslaer Polytechnic Institute and holds an M.S. from M. I. T. Dr. Curry received his Ph.D. at the University of Wisconsin and was recently with American Cyanamid Co. Mr. Wiech, a graduate of Harvard College, was previously associated with Crucible Steel Co. of America and Heyden Chemical Corp.

* * *

Julio G. Bejarano has been named executive vice president of Julius Hy-

BLAST
equipment clean
in half the time
This dirt-dynamiter cleans and rinses at the twist of a valve – no more hand-scraping, scrubbing, brushing.
The Oakite 481 Solution-Lifting Gun hits soil with heat, force, powerful Oakite detergent. Breaks up, floats off even the heaviest soils, no matter how hard to reach. Lifts cleaning spray up to 12 feet above working level.
Light, easy to operate, gun is equipped with rubber safety apron, insulated handles, and swivel to prevent twisting of lines. No pumps, injectors, motors needed – just rubber hose, solution container, 30 lbs. of steam.
Hook it up to your snuffer lines and you're ready to clean up around processing units, docks, salvage areas, garages, power houses, pipe stills, decks, gridwalks, etc.
Try it yourself. Ask your local Oakite Technical Service Representative. Or write Oakite Products, Inc., 44C Rector St., N. Y. 6, N. Y.
SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
Technical Service Representatives in Principal Cities of U. S. & Canada

(To obtain more data on advertised products see page 1032)



Whether you slap-trowel it... or gun it...

Slap-troweling a long lasting Blazecrete lining on a boiler wall

You reduce refractory maintenance costs with J-M BLAZECRETE

Labor costs for refractory maintenance are materially reduced when you build and repair high-temperature equipment linings with Johns-Manville's new hydraulic setting Blazecrete.*

Just mix Blazecrete with water—as you would mix ordinary concrete—then apply it by gunning or slap-troweling. It goes on fast . . . without laborious ramming or tamping . . . *and it lasts.* Even in foundries—where refractories take a real beating—Blazecrete linings have proved that they can resist spalling, withstand slagging action, and remain unaffected by rapid changes in temperature.

Three types of Blazecrete are available. All harden on air curing, do not require pre-firing. They can be fired or left standing indefinitely. Each of the three types described below, is furnished as a dry mix . . . can be stored safely for use as needed.

3X BLAZECRETE

For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for building and repairing forge furnace linings, lime kilns, burner blocks—and for lining ladles in ferrous and non-ferrous foundries.

STANDARD BLAZECRETE

For temperatures through 2400F. For building new and repairing old refractory linings. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X and L. W. Blazecrete.

L. W. BLAZECRETE

For temperatures through 2000F. An *insulating* refractory . . . light in weight, low in thermal conductivity. For building new linings and repairing old. Adaptable and economical for many other applications.

For further details, send for Brochure RC-28A. It also tells about Blazecrete's companion material, Firecrete*—the hydraulic setting castable refractory for making special shapes and linings. Just write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Johns-Manville BLAZECRETE

REFRACTORY LININGS

(To obtain more data on advertised products see page 1032)

Personals

man & Co.'s insecticide factory at Denver, Colo. The company was recently acquired by Shell Chemical Corp. Mr. Bejarano was plant manager at Dominguez for six years prior to his new appointment. He will manage the Denver plant.

Other appointments: **Glenn Pu cell**, 23-year Shell veteran who was superintendent of the Houston plant, succeeds Mr. Bejarano as manager of the Dominguez plant. **Russell L. Kittle**, assistant plant superintendent at Dominguez, becomes superintendent of the Houston plant.

* * *

Harry D. Kolb has been named to head a new staff function for the Esso Standard Oil Co. which will be to promote and coordinate an expanded employe communication program. Designated as the Information Division of the Employe Relations Department, the group will be responsible for establishing through line managements, more effective communication among management, unions, supervisors, and employes.

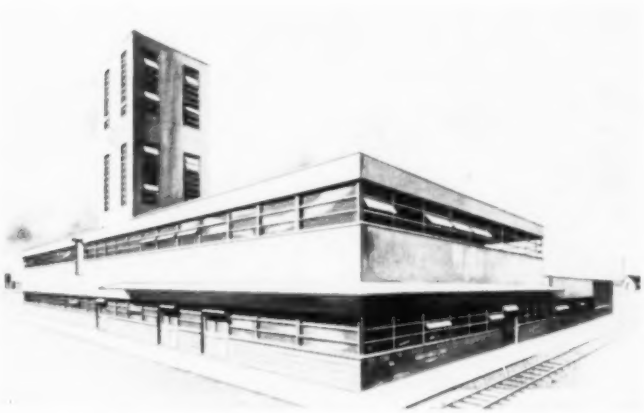
Mr. Kolb

Mr. Kolb is a former chairman of the Committee on Training in Refining of the API Division of Refining (1948). He joined the company in 1934 in the sales engineering department and subsequently served as editor of its technical publications. A graduate of Carnegie Institute of Technology, Mr. Kolb holds a master's degree in aeronautical engineering from the University of Michigan.

* * *

Dr. W. Nelson Stoops has been appointed to assistant director of research in physical chemistry at Carbide and Carbon Chemical Co.'s South Charleston, W. Va., plant. He has been active in the research and development department for the past 18 years. He received his undergraduate training at Wooster College in Ohio and received his Ph.D. in physical chemistry from Princeton University.

JAMES P. O'DONNELL
Engineers
•
PETROCHEMICAL PLANTS
•
DESIGN—PURCHASING
INSTRUMENTATION
CONSTRUCTION SUPERVISION
•
39 Broadway New York 6



Kellogg Expands Manufacturing

New plant for the manufacture of "Kel-F," a high temperature and corrosion resistant fluorocarbon plastic material developed by M. W. Kellogg Co., now under construction at the company's manufacturing and development center in Jersey City. Scheduled for completion before the end of 1952, the new continuous processing facilities will increase Kel-F production to over a million pounds a year.

Midwest Piping Adds To St. Louis Plant

Recently completed addition of Midwest Piping and Supply Co. Inc.'s (St. Louis) welding fittings manufacturing plant increases floor space 48,000 sq. ft. and more than doubles the pressing and welding capacity. With equipment, the structure represents an investment of one-half million dollars.

Pennsalt Integrates Research

The research department of Sharples Chemicals Inc. will be integrated with the research and development division of the parent company, Pennsylvania Salt Manufacturing Co., sometime between June 15 and September 15. Laboratory facilities at Whitemarsh Hall near Philadelphia are being considerably extended by the conversion of additional rooms to laboratories and existing facilities are being rearranged to provide not only for the addition of Sharples research personnel but also to increase Pennsalt's facilities.

Dr. John F. Gall, currently supervisor of research, will become director of the inorganic research department and will be responsible for the company's research work in surface chemistry, inorganic synthesis, electrochemistry and high-temperature chemistry.

Dr. John F. Olin, director of research for Sharples, will be the director of the organic research department in the new organization, with Dr. George McCoy, at present Pennsalt's organic group leader, as technical assistant director, and T. E. Deger, Sharples assistant research director, as administrative assistant director. The analytical section will be given department status with Dr. Paul A. Munter as supervisor.

Moore Promotes Valentine

H. Dean Valentine has been appointed assistant sales manager of Moore Products Co., industrial instrument manufacturers, Philadelphia. Mr. Valentine came to the Moore organization in 1945, and has recently acted as sales engineer for the Philadelphia and Wilmington territories. He has been active in instrumentation since 1939 and is now vice president of the Wilmington section of the Instrument Society of America.

Joins Catalytic Construction

Weldon Riley Burns has joined Catalytic Construction Co. in its oil refinery division as a senior project engineer. His entire career has been in the petroleum field since his graduation from the University of Oklahoma in 1933 with a B. S. in petroleum engineering. Mr. Burns' most recent association was with the Badger Process Division of Stone and Webster Engineering Corp. where he served as a project engineer.

NGAA Honors Schlueter

W. A. Schlueter, president of Refinery Supply Co. of Tulsa, and vice president of Central Scientific Co., Chicago, was presented with a medal for helpful instrument service in the natural gasoline industry at the recent Natural Gasoline Assn. of America meeting in Houston. Mr. Schlueter's contribution to the standardization of testing methods in the petroleum industry goes back over 40 years when he helped develop the Saybolt Chronometer, the Saybolt Viscosimeter, the Tagliabue Open Cup Flash and Fire Tester.

U. S. Electrical Motors Expands

Stepping up its expansion in Los Angeles to adequately provide facilities for an increasing backlog of orders, U. S. Electrical Motors Inc. is now operating in five separate metropolitan points, all in close proximity. Actual increase in space recently acquired amounts to an additional 40% of shop and office area of the Los Angeles facilities.

While administration headquarters remain at the principal plant in the 200 block on East Slauson Ave.,

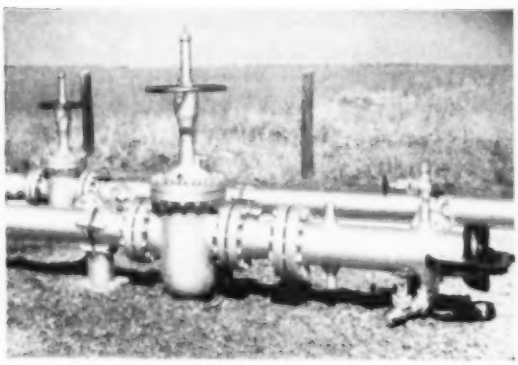
for smoother flow
easier operation
longer service life

...CRANE *CLASS 600*
OIL AND GAS PIPE-LINE VALVES

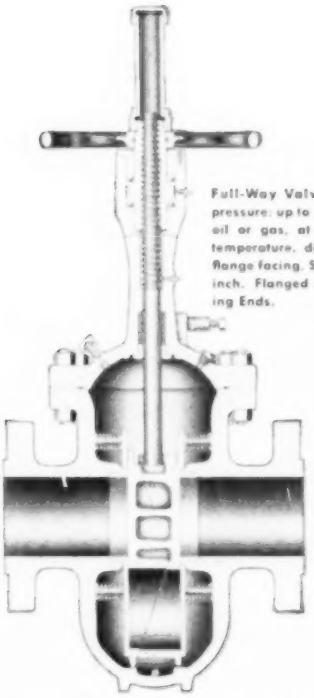
You get many advantages with these conduit-type, double seating Crane Pipe-Line Gates. For example, smooth, full flow with minimum restriction . . . no turbulence. Circular disc ports—in perfect alignment with seat openings—eliminate pockets. This Crane design feature helps assure tight closure.

Grease packed body and bonnet assure easier valve operation . . . less maintenance. All working parts are lubricated to reduce friction and wear. And since Crane double seating design seals off seating faces from line flow, seat erosion is eliminated.

For further information, see your Crane Representative or write for Circular AD-1864. No obligation.



Crane cast steel pipe-line gate valves on scraper trap in crude oil lines.



Full-Way Valve. Working pressure: up to 1440 pounds oil or gas, at atmospheric temperature, depending on flange facing. Sizes: 2 to 30-inch. Flanged or Butt-Welding Ends.

COMPLETE GREASE SEALING

Movable spring-loaded plates prevent grease entering line flow while valve is being operated . . . also close "conduit" openings in disc against entrance of grease.

In addition, plates wipe foreign matter and excess grease from disc faces and assist in guiding the disc. Readily accessible fitting in bonnet permits easy addition of grease when needed.

Venturi Type, available with flanged or butt-welding ends.

CRANE CO.

General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

GOT A
DIZZY
FITTING PROBLEM?

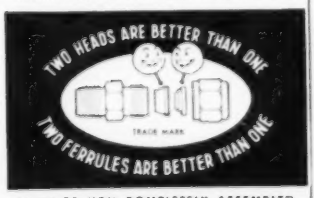
Consult Crawford
Tube Fitting Specialists—And Get The
Swagelok* ANSWER

Try to stump us! For "specials" send your tube fitting problems to us and let our engineers design a Swagelok Special that will do the job. Ask for FREE catalog. Dept. 62

* Patented

CRAWFORD FITTING CO.
884 E. 140th Street, Cleveland 10, Ohio

SWAGELOK FITTINGS AVAILABLE IN BRASS, ALUMINUM, STEEL, STAINLESS STEEL, MONEL



COME TO YOU COMPLETELY ASSEMBLED, FINGER TIGHT

News of Suppliers

other buildings have been leased within a one mile radius. One of the additional buildings is a large reinforced brick 2½-story building at 150 W. Slauson Ave. which is now occupied by its engineering and service divisions. Another building at 6550 Avalon Blvd. has been equipped for the exclusive production of aircraft electrical motors. Two other buildings have been acquired for warehousing in order to provide room in the main plant for new machinery.

Jefferson Expands at Austin

Jefferson Chemical Co. Inc. has approved a major addition to its present laboratory buildings at 7414 Georgetown Rd., Austin, Tex. Tentative plans call for a two-story laboratory building, approximately 60 by 200 ft., of concrete and hollow tile construction. This is the second expansion in what Jefferson expects to be a series of additions to its research and development facilities during the coming years.

Kuehne, Brooks and Barr, Austin architects, are studying long range expansion possibilities and are drawing preliminary plans for the two-story laboratory addition. According to present estimates, ground will be broken for the new construction during the fourth quarter of this year.

Joins National Aluminate Sales

Edward R. Hayes, formerly with the research department of the Standard Oil Co. (Ind.) has recently joined the sales staff of the catalyst division, National Aluminate Corp. He will serve as technical representative in connection with sales of "Nalcat" cracking catalyst to the petroleum refining industry.

Prior to joining Indiana Standard, Mr. Hayes attended the University of Maine and Cornell University to study chemical engineering. He was awarded an M. S. degree in chemical engineering from Cornell in 1948.

Nominated as ASME President

Frederick S. Blackall, Jr., president and treasurer of Taft-Peirce Mfg. Co. of Woonsocket, R. I., has been nominated for the 1953 presidency of the American Society of Mechanical Engineers. Election will take place in the Fall by letter ballot of the membership of over 35,000 engineers. The new officers will begin their terms at the conclusion of the ASME annual meeting next December. Mr. Blackall will succeed Reginald J. S. Pigott, director of the engineering division of Gulf Research and Development Co.

Regional vice presidents nominated include: Henry R. Kessler, (renomina-

A Complete Line of
COMBUSTION
ACCESSORIES
for Every Industrial Liquid Fuel-Gas Installation

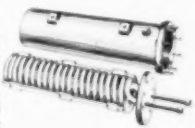
Air Control Door and Frame: top hinged, ratchet type, heavy duty, for manual control. Surfaces are machined to a close fit.

Fuel Oil Suction Strainer, single type. Large basket area insures low pressure drop; cover and basket easily removed for cleaning.

Wide View Peephole, safety curtain type. Cobalt glass removed to show bearing surface for curtain. Curtain halves are interlocked—open simultaneously.

Ignition Port with Refractory Tile No. M896 . . . for use with standard 3" pipe. Also serves as a peephole.

Furnace Relief and Access Door, heavy construction, practically air tight. Door casting correctly weighted, lined with plastic refractory retained by imbedded grill, with observation port and cover.



Fuel Oil Heater, Self Cleaning, Spiral Coil Type. High oil velocity in coil, resultant turbulence prevents carbon formation. No internal connections or joints.

The "right combination" for you in achieving maximum combustion economy is NATIONAL AIROIL Fuel Oil, Gas or Combination Oil & Gas Burning Equipment, NATIONAL AIROIL Combustion Accessories, and NATIONAL AIROIL Engineering Consultation. May we be of help to you in accomplishing your particular installation or in solving that difficult problem?

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.
1297 EAST SEDGLEY AVE., PHILA. 34, PA.
Southwestern Division
2512 South Boulevard, Houston 4, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

(To obtain more data on advertised products see page 1032)

This Plant Claims Their

HEAT SAVINGS PAID for NICHOLSON TRAPS

Nicholson expansion steam traps were installed by a processor on tank heaters and coils where various unit temperatures from 160 to 185 F had to be maintained. The steam temperature was 320 F. Figuring the difference in heat loss between Nicholson traps discharging condensate at 160 and others discharging it at about steam temperature, they feel heat loss was cut nearly in half. Due to their effectiveness in controlling temperature as well as draining condensate, Nicholson traps are paying for themselves in many industries.

For All Equipment Using Steam or Hot Water

CATALOG 751 OR SEE SWEET'S

Absorption Stills, Agitators, Evaporators, Gas Holders, Heat Exchangers, Heavy Oil Tanks, Kettles, Petrolatum Tanks, Pipe Coils, Radiators, Reboilers, Steam Stills, Tar Tanks, Wax Tanks

215 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

EXCEL-SO

Combination

SEPARATOR-FILTER-AIR ELIMINATOR

FOR REMOVAL OF BULK QUANTITIES OF WATER, SCALE, ROUGE AND AIR—

SEND FOR DESCRIPTIVE BULLETIN FEQ-51

..from Refinery or Gasoline Plant Process Streams, Pipe Lines, Tank Car Loading, Marine Refueling, Truck Loading Racks, Airport Refueling Trucks, and Airport Refueling Systems.

Wherever gasoline or light oils may be contaminated by water, scale, muck, or air—EXCEL-SO can be depended upon to deliver clean, dry fuel.

WARNER LEWIS COMPANY

BOX 2096 • TULSA, OKLAHOMA

News of Suppliers

tions manager, Republic Flow Meters Co., New York; Paul R. Yopp, district sales manager, Babcock & Wilcox Co., Atlanta, Ga.; Ben George Elliott, professor of mechanical engineering, University of Wisconsin, Madison, Wis.; Harry R. Pearson, personnel director, Dallas Power and Light Co., Dallas, Tex.

Nominated as directors-at-large: David W. R. Morgan, vice president, Westinghouse Electric Corp., Philadelphia; Ralph L. Goetzenberger, vice president, Minneapolis-Honeywell Regulator Co., Washington, D. C.

Swanson Up at Kellogg

Paul F. Swanson has been named manager of the process engineering department of the M. W. Kellogg Co. In his new position, Mr. Swanson will be in charge of the firm's large staff of process engineers, now in the designing stages of over 20 major petroleum refining and chemical processing plants throughout the world. Mr. Swanson came to Kellogg 25 years ago, immediately upon his graduation as a chemical engineer from the University of Kansas. He was prominent in the development of the first continuous catalytic cracking process utilizing the Fluid catalyst principle. Most recently, his experience has been applied to Kellogg's part in the development of Fluid Hydroforming.

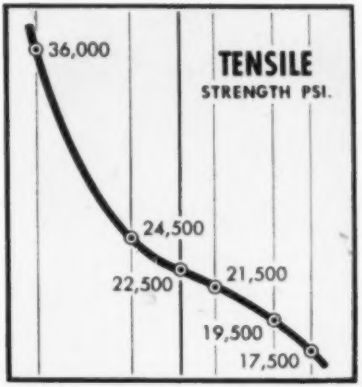
Mr. Swanson

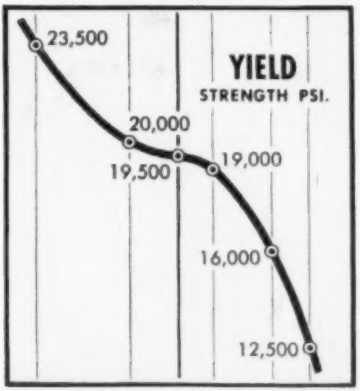
Nordberg Man to Vancouver

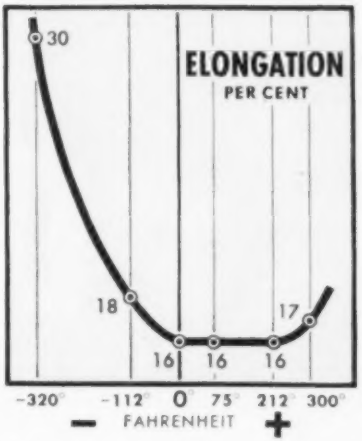
S. C. McComb has been appointed western Canadian representative of the heavy machinery division, Nordberg Manufacturing Co., with headquarters in Vancouver, B. C. His career is a colorful one, covering 28 years in capacities such as junior engineer aboard tankers of Standard Transportation Co. of Hong Kong, senior engineer with the China Navigation Co., in which position he handled the company's efficiency program for a fleet of ships, and specialist in municipal water work and industrial diesel engine applications. In 1935 he was named chief executive engineer of the Macaau Water Development Scheme in South China for the Hong Kong-Shanghai Banking Corp. From 1939 to 1945 he saw service with the Royal Canadian Navy, and after his discharge in late 1945 joined in a business partnership specializing in diesel engines in the electric generating field. He retained this association until 1948 when he joined Simplex Engine Co. as sales

FACT ABOUT LOW-TEMPERATURE PROCESSING

Alcoa Aluminum Heat Exchanger Tubes actually increase in strength as temperatures drop to −320°F. and below. Alloy 3S-H14, for example, improves 67 per cent in tensile strength, 23 per cent in yield strength and more than 80 per cent in elongation. Thousands of feet of Alcoa Tubes are now in use for tonnage oxygen production, nitrogen removal, dewaxing, propane chilling, ethylene extraction and many other low-temperature processes.







ALCOA

knows most about their use and application

Alcoa pioneered the use of aluminum in heat exchanger tubes 43 years ago. For complete information on their application and installation, write for a copy of the booklet, *Alcoa Aluminum Heat Exchanger Tubes*. Write:

ALUMINUM COMPANY OF AMERICA
1863-G Gulf Building • Pittsburgh 19, Pa.

OVER 6-MILLION FEET OF ALCOA TUBES ARE IN USE FOR APPLICATIONS LIKE THESE:

PETROLEUM

- Condensers handling hydrocarbon fractions from such processes as Thermal and Catalytic cracking, reforming, polymerizing, etc.
- Vapor recovery condensers
- Lube oil coolers
- Natural gas compressor after-coolers
- Recompressor after-coolers
- Hydrogen sulfide gas coolers
- Furfural condensers and heat exchangers
- Propane chilling
- Wax sweaters
- Lean oil — rich oil exchangers
- Amine solution coolers
- Glycol-amine heat exchangers and reboilers

CHEMICAL

- Butanol
- Ethanol
- Ethylene Glycol
- Glycerin
- Hydroabietyl
- Isopropanol
- Methanol
- Phenol
- Propylene Glycol
- Acetaldehyde
- Formaldehyde
- Furfural
- Heptaldehyde
- Acetic acid
- Stearic, Palmitic, Maleic Oleic acids
- Butyric acid
- Naphtha
- Ricinoleic acid
- Acetanilide
- Ammonia
- Hydrogen Cyanide
- Nitric acid (concentrated)
- Pyridine
- Hydrogen Sulfide
- Benzene
- Dichlorobenzene
- Gelatin
- Hydrogen Peroxide
- Turpentine
- Xylene

Use Alcoa Alclad 3S-H14 Heat Exchanger Tubes with fresh, brackish and salt-cooling waters

POWELL gives you flow control at its best!

Advanced engineering, laboratory control of all materials, expert workmanship and over a century of manufacturing experience make Powell Valves what they are today—flow control equipment at its best.

And because they are made to suit the service, there are more kinds of Powell Valves in use today than of any other individual make.

The Wm. Powell Company
Cincinnati 22, Ohio

Fig. 2453-G. Large 150-pound O. S. & Y. Gate Valve. All the dimensions conform to the latest standards. Can be furnished in Stainless Steels Hastelloy Alloys Monel Metal Herculoy Everdur Inconel Nickel and other metals and alloys.

POWELL

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

DEPENDABLE VALVES SINCE 1846

manager. In 1950 he was employed by A. R. Williams Machinery Co. and placed in charge of diesel and gasoline marine engine sales.

Solvay Divisions Consolidate

Effective since June 1, The Solvay Process Division and the Solvay Sales Division of Allied Chemical & Dye Corp. has been consolidated and known as The Solvay Process Division. This division is responsible for production and sale of alkali, chlorine and related products. It will continue to sell the chlorine produced by the Nitrogen Division.

H. F. Merritt, formerly executive vice president of Solvay Sales Division, has become vice president of the Solvay Process Division in charge of sales. L. B. Gordon, formerly vice president of the Solvay Sales Division, has become a vice president of the Solvay Process Division. On June 9, the executive sales office moved from 40 Rector St. to 61 Broadway and consolidated with the Solvay Process executive office.

Vulcan Opens New York Office

The Vulcan Copper & Supply Co. of Cincinnati, engineers and manufacturers of equipment and plants for the chemical and petrochemical industries, opened a New York office on July 1 to represent its engineering, manufacturing, and construction divisions. The office

Mr. Drummond

Mr. Katzen

is located in the new Chrysler Bldg. East at 161 East 42nd St.

V. D. Drummond, former manager of the Vulcan Engineering Division, has become manager of the New York office. Dr. Ralph Katzen has succeeded Mr. Drummond as manager of the engineering division. In addition to Mr. Drummond, personnel in the office will consist of Harry G. Alwine and Jacques G. Devys. Mr. Alwine is a sales representative and Mr. Devys represents Vulcan in offering plants and equipment using certain specialized European chemical processes.

Mr. Drummond is a graduate of

how flexible CAN YOU GET!

WITH EXPANSION JOINTS IT'S Badger

In the national pastime there are new stars every year — but when it comes to expansion joints Badger is a consistent leader in the field year in and year out.

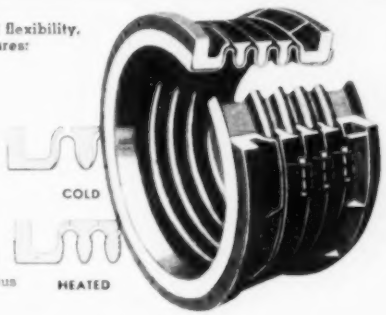
The built-in flexibility and long life of Badger Expansion Joints assures protection against damage to equipment by absorbing the expansion and contraction in piping due to temperature changes.

*D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

Buy Badger Joints and you get flexibility, D-F S-E and these features:

- Packless . . . pressure-tight single tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.

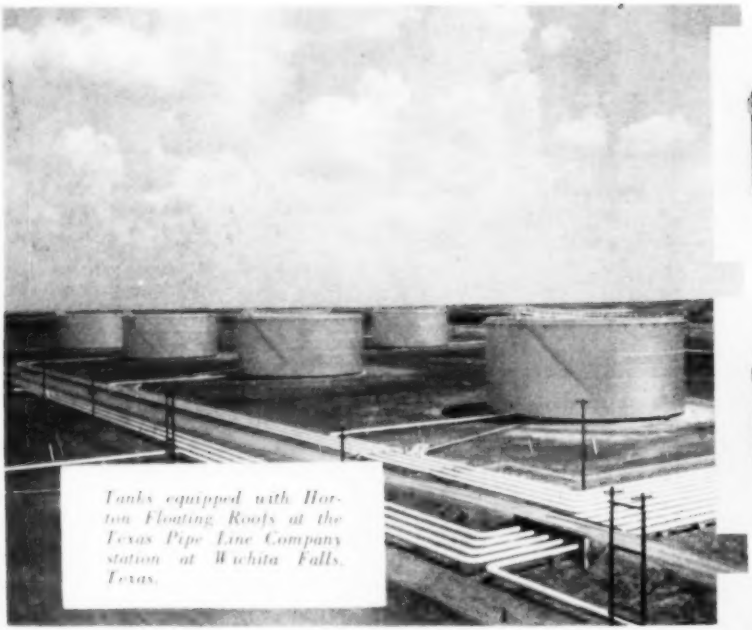


Original and Sole Manufacturer of Badger Expansion Joints

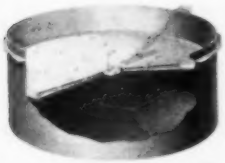
BADGER MANUFACTURING COMPANY

230 BENT STREET • CAMBRIDGE • MASS.

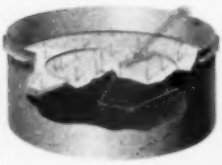
(To obtain more data on advertised products see page 1032)



Tanks equipped with Horton Floating Roofs at the Texas Pipe Line Company station at Wichita Falls, Texas.



Double Deck Roof



Pontoon Roof

Pan Roof

Reduce Costly Evaporation Losses from Working Storage Tanks with HORTON FLOATING ROOFS

The efficient handling of gasoline, crude oil, and similar volatile liquids requires the use of modern storage equipment. For many years the petroleum industry has utilized Horton Double-Deck, Pontoon, and Pan Floating Roofs to eliminate breathing and filling evaporation losses, cut down corrosion and reduce the danger of fire during working storage.

The Horton Double-Deck Floating Roof has a double deck over the entire surface of the liquid, and a vertical rim at the periphery. The roof is divided into a number of compartments by circular rims and radial bulkheads to provide stability. The top deck is sloped to the center to assure drainage.

The Horton Pontoon Floating Roof has an annular pontoon and a center section of single thickness. The pontoon ring is compartmented by radial bulkheads to assure stability. Trusses are placed inside the pontoon compartments to provide stiffness.

The Horton Pan Floating Roof has a deck of single thickness with a vertical rim at the periphery. The deck is coned downward toward the center to provide drainage. It is held in this position by a series of radial rafters attached to the underside of the deck and radial trussing above the deck.

Complementing the effective design of all three types of Horton Floating Roofs is the improved Horton Seal which efficiently closes the space between the rim of the roof and the tank shell.

Horton Floating Roofs, Hortonspheres, Hortonspheroids, Hortondome Roofs, Hemispheroids and Horton Vapotspheres are products of the Chicago Bridge & Iron Company. They have been proven in thousands of installations throughout the petroleum industry.

For more information please write our nearest office. There is no obligation on your part.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3 ... 1118 Healey Building ... Denver 22 ... 1537 Fillmore Building ... Philadelphia 2 ... 1630—1700 Walnut St. Building
Birmingham 3 ... 1427 Brown-Marx Building ... Houston 2 ... 400 Milam Building ... San Francisco 4 ... 1119—255 Post Street
Boston 10 ... 1906—201 Devonshire Street ... Kansas City 6 ... 2520 Bal-Tim Building ... Seattle 1 ... 1206 Henry Building
Chicago 4 ... 1711 McCormick Building ... Los Angeles 17 ... 1124 Gladden Petroleum Building ... Tulsa 3 ... 1620 Hunt Building
Cleveland 15 ... 1220 Guardian Building ... New York 6 ... 2310—165 Broadway Building ... Washington 6, D. C. ... 1130 Colorado Building

REPRESENTATIVES AND LICENSEES

Nuclear Power Works, East Pittsburgh, Pennsylvania ... Compagnie Française Industrielle Babcock, Rueil, France
Ateliers de Chaudronnerie de la Meuse, Mezières, France ... Whessoe Limited, Darlington, England
Compagnie Française de Babcock, Ateliers Réunis, France ... McDowell Bridge & Engineering Company, Limited, Motherwell, Scotland
Babcock & Wilcox Company, Limited, Renfrew, Scotland ... Comptoir Belge S. A., Antwerp, Belgium ... Ateliers Metallurgiques de Hainaut, Tubize, Belgium
Babcock & Wilcox Tube Company, Beaver, Pennsylvania ... Babcock & Wilcox Company, Limited, Montreal, Canada

Oklahoma A. & M. College and Stevens Institute. Before joining Vulcan he held positions with the American Locomotive Co., Standard Oil Development Co., and Publicker Industries.

Dr. Katzen holds degrees from Brooklyn Polytechnic Institute in chemical engineering. He came to Vulcan eight years ago and has held various positions in the engineering division. Prior to joining the company he was employed by Diamond Alkali Co. and Northwood Chemical Co.

Dowell Makes Sales Changes

Three changes in the sales and management staff of Dowell Inc. have been made which involve the promotion of R. D. Shaw, Tulsa, to the newly-created position of director of sales; Marshall Stirling, sales manager of the petroleum division in Fort Worth, to general sales manager, replacing Mr. Shaw; and W. N. Estel, who has been sales development manager, to assistant general manager to be directly responsible for an entirely new department of employe-public relations which is now being organized.

Mr. Shaw

Mr. Stirling

Mr. Estel

Mr. Shaw has been with the company since 1932. A native of Ovid, Mich., he received his B. A. from the University of Michigan.

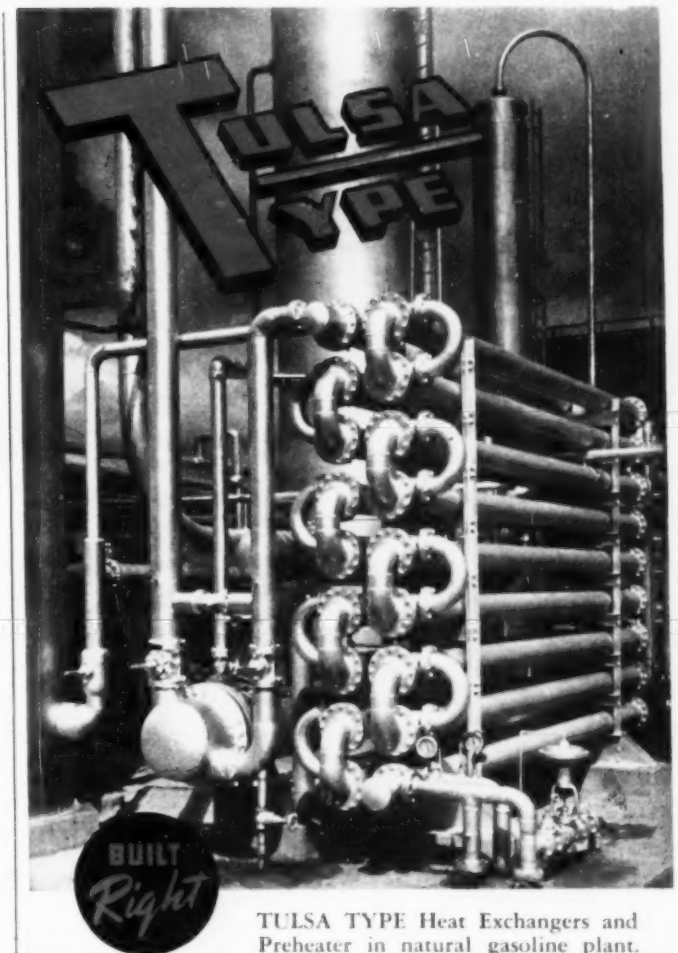
Mr. Stirling was previously located in Tulsa as sales manager of the petroleum division before moving to Fort Worth in late 1950 to head an expansion program in that area. He has been with Dowell since 1939. Born in Georgetown, Tex., Mr. Stirling attended Southwestern University at Georgetown.

Mr. Estel has been with Dowell since 1940, joining the company as a service engineer. He is a native of Altenburg, Mo., and attended Tulsa University where he gained fame on the gridiron. It was early in 1948 when Mr. Estel was placed in charge of the West Texas operating area as district manager at Midland, Tex. In 1950 he moved to Tulsa as sales development manager.

Heads DuPont's Export Sales

Walter Mees has been appointed to head E. I. duPont deNemours and Co.'s petroleum chemicals export sales section. The appointment was made in connection with a substantial expansion of DuPont's export organization handling such petroleum chemicals as antiknock compounds, gasoline dyes and antioxidants, metal deactivator, grease stabilizers, lube oil additives, and octane.

Mr. Mees was born in Hengelo, Holland, and in 1929 joined the Royal Dutch Shell group where he served in various capacities with Shell subsidiaries in South America and a number of European countries. He handled various phases of DuPont's domestic petroleum chemicals sales prior to his recent appointment.



TULSA TYPE Heat Exchangers and Preheater in natural gasoline plant.

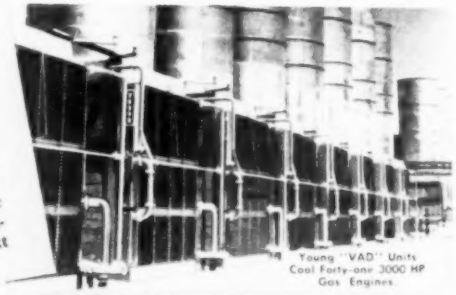
FLINT STEEL CORPORATION
TULSA, OKLAHOMA

(To obtain more data on advertised products see page 1032)

YOUNG

SELECTED FOR COOLING ONE OF THE WORLD'S LARGEST INTERNAL COMBUSTION PLANTS

Reynolds Metals Company's new aluminum reduction plant at San Patricio, Texas, has been proclaimed one of the world's largest and finest internal combustion installations. Here 83 natural gas driven Diesel engines generate 278,400 HP, and develop a total of 543,000,000 BTU per hr., which must be dissipated. Young's heat transfer organization . . . with completely integrated facilities for the design, development, manufacture, testing, rating, and installation servicing of specialized heat transfer equipment was commissioned to handle the cooling job. 83 rugged, compact, thermostatically controlled units, for cooling the Engine Jacket Water and Lube Oil, plus 84 Supercharger Air Intercoolers for increasing both horsepower and efficiency of engines, were delivered by Young. Certified Ratings and more than a quarter century of proved performance in the field assure complete satisfaction. Take advantage of this experience . . . specify that your next job is Young-engineered.



Young "VAD" Units Cool Forty-one 3000 HP Gas Engines

Young "HC" Units Cool 42 Cooper-Bessemer 3700 HP Gas Engines

25 YEARS OF PROGRESS

YOUNG

Heat Transfer Products for Industrial and Automotive Applications

Cooling, Heating, Air Conditioning Products for Industry and Home

YOUNG RADIATOR COMPANY

Data On Hydrocarbon Behavior Aids Process Engineering Work

Data Book on Hydrocarbons, second printing, by J. B. Maxwell. 7¼ × 10¼ in., 409 + 258 pages, indexed, soft cover, binding. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. $5.50

This book provides basic data on hydrocarbons and petroleum fractions, methods of applying these data to process engineering, and applications of a few unit operations of chemical engineering used extensively in the petroleum industry. Numerous charts and tables are provided for handy reference to hydrocarbon characteristics.

In the section under Unit Operations, fluid flow is discussed with relationships to friction factors, pressure drops in pipes and across tube banks, and discharge characteristics of weirs. The chapter, "Flow of Heat," covers heat loss by radiation and natural convection, heat transfer to fluids inside and outside tubes, and thermal conductivity of petroleum fractions, water, and gases.

A chapter is devoted to "Equilibrium Flash Evaporation," which describes the flash vaporization curve as a plot of temperature against liquid volume percent vaporized, the total vapor being in equilibrium with the unvaporized light at constant pressure. A six-step method, designed to be reasonably accurate, is outlined for predicting the atmospheric flash curve of a reduced crude.

"Fractionating Towers" is the chapter which supplies interesting data on location of the feed plate, plate efficiency, and packed towers. It includes such useful plotted graphs as 1) correlation of theoretical steps with reflux ratio of multicomponent and binary mixtures, 2) overall plate efficiency vs. fluidity of liquid on plates, and 3) pressure drop in packed towers. In the second of these above-mentioned graphs, only data on hydrocarbon mixtures were used in the correlation since there was insufficient data on other types to justify a more general use. However, there was some evidence that showed the curve to be a little conservative for alcohol-water mixtures.

The book was first published in 1950 for use by the engineering department of the Standard Oil Development Co., and because it proved its value to their technical personnel, the company decided to make it available to practicing engineers and students of petroleum technology. The author, J. B. Maxwell, is a chemical engineer with Standard Oil Development.

Tube Standards Book Adds Information Section

Standards of Tubular Manufacturers Association, Third Edition 1952, 8½ × 11 in., 188 pages, indexed, semi-flexible cloth-reinforced leather cover with ring binding. Tubular Exchanger Manufacturers Association, 370 Lexington Ave., New York 17, N. Y. $5.50, postpaid.

The new Third Edition of the **Standards of Tubular Manufacturers Association** comprises 58 more pages than the previous (1949) Edition. Earlier volumes covered standard nomenclature, material specifications, thermal standards and maintenance suggestions, as well as mechanical standards for carbon steel and nonferrous alloy construction, both for Class R heat exchangers designed to comply with API-ASME codes, and Class C heat exchangers, non-code construction for commercial applications.

The new edition has been revised and a general information section has been added to provide a reference source for designers and users of heat exchangers. Contained in the section are the TEMA Standards, and tables on maximum allowable stress values of carbon, low and high alloy steels, nickel and high nickel alloys, copper and copper alloys, carbon and low alloy steel pipe and tubes. This information was incorporated to make the book especially useful to the chemical, petrochemical and process industries.

Symposium Papers Cover Instrumentation Usage

Instrumentation for the Process Industries, 1951 sixth annual symposium conducted by the department of chemical engineering, Agricultural and Mechanical College of Texas, College Station, Texas, August 13-14, 1951, 8½ × 11¼ in., 82 pages, illustrated, paper cover. The Instruments Publishing Co., Inc., 921 Ridge Ave., Pittsburgh 12, Pa. $2.50

Written by authorities in the refining and chemical process industries, seven articles are presented in this booklet covering many aspects of instrumentation. "Problems in Refinery Control" by E. D. Mattix, technical assistant to the operating superintendent, Cities Service Refining Co., covers such topics as, 1) pH control of water draw-offs, 2) steam-air decoking of furnaces, 3) controlling flow of 50° Baume caustic, and 4) final range mercury-manometer flow meters.

J. S. Detweiler, divisional sales manager of Taylor Instrument Co., presents "Instrumentation of a Synthetic Rubber Plant." Many flow diagrams and illustrations accompany the article to illustrate its main points more effectively.

Interesting discussions, pertinent to the material presented, follow each article. All who attended the symposium were invited to take part in the discussion periods.

API-ASME Add To Scope Of Unfired Vessels' Code

API-ASME Code for the Design, Construction, Inspection and Repair of Unfired Pressure Vessels for Petroleum Liquids and Gases, 1951 edition, 1951, sponsored by The American Petroleum Institute and The American Society of Mechanical Engineers, 8½ × 11 in., 285 pages, paper cover, $3.00.

This fifth edition contains the table of stress values for carbon steels and low alloy steels identical with that in the forthcoming 1952 edition of Section VIII on "Unfired Pressure Vessels of the ASME Boiler Section Code."

Among the changes from previous editions are: more accurate shell and head design formulae; details for minimum welding required around opening attachments; acceptance criteria for pressure-relief devices; and information pertaining to the proving of materials not completely identified.

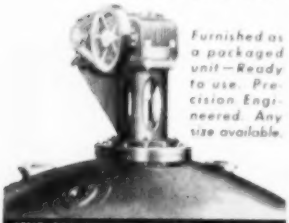
Editors, Engineers Write on Latest Processes

Modern Chemical Processes, Volume II, by the editors of *Industrial and Engineering Chemistry*, in cooperation with the technical staffs of cooperating companies, 8½ × 11¼ in., 299 pages, illustrated, indexed, cloth binding. Printed for the American Chemical Society by Mack Printing Co., Easton, Pa. $5.00.

The twenty-four articles in this book contribute significantly to the techniques and processes now used in the chemical and petroleum industries. A description of Old Dutch Refining Co.'s "Platinum Reforming of Gasoline" and a chapter on "Liquid Fuels from Oil Shale," are probably the outstanding articles of interest to PETROLEUM PROCESSING readers.

Polyforming, hydroforming, platforming, and process variables are covered in Old Dutch's process. Included in the article is a flow diagram of the process, and a description of the graphic control panel. Instrumentation is covered not only in this

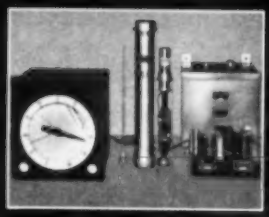
For Heavy Duty
low cost operation
"International"
AGITATOR
DRIVE HEADS
AND TURBINES
WITH ECONOMY BELT DRIVE
INTERCHANGEABLE SPEEDS
FACTORY ASSEMBLED—ALIGNED
FOR OPEN OR CLOSED TANKS



Furnished as a packaged unit—Ready to use. Precision Engineered. Any size available.

SEND FOR BULLETIN No. P63
ON TOP ENTERING MIXERS

INTERNATIONAL ENGINEERING, INC.
DAYTON 1, OHIO
NEW YORK— 18 Park Row WOrth 2-2580
CHICAGO— 407 S. Dearborn St. WAbash 2-0733



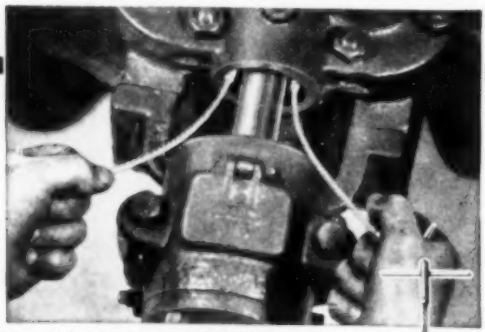
GAGETRON Applied to Measurement of Catalyst Level

New industrial application of atomic energy employs radium and hydrogen tube. Catalyst level is measured by number of atomic impulses passing through the counter tube. The primary element is the GAGETRON.

The GAGETRON is manufactured under Graham Patent No. 2,565,963.

FREE! Safety Code for use of radium. Also GAGETRON Bulletin No. 149.

INSTRUMENTS, INC.
122 N. Madison Tulsa 6, Okla.



An EASIER WAY
To Remove Packings
Use DURA HOOKS

Rugged, flexible, hand tools that "work around corners" for removing old packing from stuffing boxes. They SAVE TIME . . . put an end to hassling and cussing . . . improve your man-power efficiency. WRITE FOR DURA HOOK Bulletin DH PP covering SIZES and PRICES.

★ All Steel Flexible shaft
Tempered tool steel corkscrew bit

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

Books

article, but its merits are discussed in "Kraft Papermaking," "Commercial Development of Glyoxal," and "Chemicals from Fats."

A comparison of shale oil and petroleum diesel fuels is included in the description of refining "Liquid Fuels from Oil Shale." Union Oil Co. of Calif.'s retort is described, together with diagrams and descriptions of other retorting processes.

The only criticism offered and it is a minor point, is the fact that the flow diagrams are outlined with too heavy black borders which detract somewhat from the drawings. In spite of this minor flaw, the book rates a first class recommendation.

The first volume appeared in 1956 with 23 articles. Each plant process article is written by an associate editor in collaboration with company engineers and operating officials. In the Foreword, written by Walter J. Murphy, editor of *Industrial & Engineering Chemistry*, he acknowledges the efforts of D. O. Myatt, managing editor, in directing the series.

Books Received . . .

A Practical Guide to LP-Gas Utilization, by Earle A. Clifford. 8½ x 11½ in., ii + 405 pages, illustrated, cross reference index, stiff cloth binding. Moore Publishing Co. Inc., 48 West 38th st., New York 18, N. Y. $4.50.

Technical Cooperation With Underdeveloped Countries, by Philip C. Newman, John E. Gilmans, and Robert S. Aries. 6 x 9 in., ii + 98 pages, heavy paper cover. Chemonomics Inc., 400 Madison Ave., New York 17, N. Y.

Distillation Equilibrium Data, by Ju Chin Chu. 6¾ x 9½ in., x + 304 pages, data tables, chemical formulae index, stiff cloth binding. Reinhold Publishing Corp., 330 W. 42nd st., New York, N. Y. $6.00.

Methods of Analysis of Fuels and Oils, by J. R. Campbell, edited by William Gibb. 5½ x 8½ in., xii + 216 pages, illustrated, indexed, stiff cloth binding. Chemical Publishing Co. Inc., 212 Fifth Ave., New York, N. Y. $4.00.

Government Publication

The Thermodynamics of Combustion Gases, General Considerations, Bureau of Mines Report of Investigations 4806, by Stuart R. Brinkley, Jr., and Bernard Lewis. 8 x 10½ in., 61 pages, paper cover. Can be ordered free of charge from the U. S. Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

Association Publications

Measurement of Gas Law Deviations with Beam and Burnett Apparatus, Institute of Gas Technology Bulletin 13, by O. T. Bloomer, sponsored by the Basic Research Program of the Institute of Gas Technology. 8½ x 11 in., v + 12 pages, illustrated, heavy paper cover. Institute of Gas Technology, The Gas Industry's Own Educational and Research Facility, Affiliated with Illinois Institute of Technology, Technology Center, Chicago 16, Ill. $2.00.

Physical-Chemical Properties of Methane-Nitrogen Mixtures, Institute of Gas Technology Research Bulletin 17, by O. T. Bloomer and J. D. Parent, sponsored by the Technical and Research Committee, Natural Gas Department of the American Gas Association. 8½ x 11 in., iv + 36 pages, illustrated, heavy paper cover. Institute of Gas Technology, Technology Center, Chicago 16, Ill. $3.50.

HOW Carey HELPS THIS

power plant in the sky

KEEP OPERATING COSTS down to earth

Arapahoe Station,
Public Service Company
of Colorado

P. & B. Engineering and Supply Co., Inc., Houston, Texas—Insulation Contractor ● Ebasco Services, Inc., New York City, Design Engineer and General Contractor

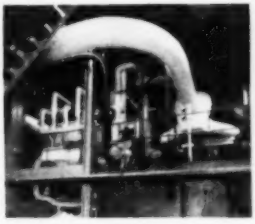
At this new 132,000 kw. steam electric generating plant—built at an elevation of over 5200 feet—Carey insulation products conserve heat, save fuel, help satisfy the West's growing appetite for low cost power.

Carey insulation products were chosen for Arapahoe on the strength of their proven ability to meet, economically, all requirements for strength, lightweight, dimensional stability and performance on a wide range of equipment, operating at temperatures to 900° F.

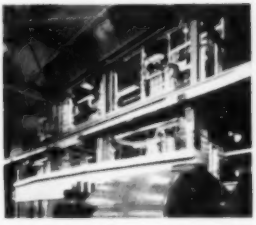
Development and manufacture of products for heat conservation has been an important Carey service to industry since 1873. That's why we believe we can solve *your* heat conservation problem, no matter how unusual it may be. The Carey line includes new, monolithic Super-Light 85% magnesia in molded pipe coverings, blocks and cements—now being manufactured in our new multi-million dollar plant. This material is light-weight, strong, easy to handle, easy to apply. It will not disintegrate or crack under normal service conditions and can be removed and reapplied, when necessary.

Call on Carey for the solution to your heat conservation problems. Use the coupon to request the latest bulletins describing uses for Carey insulation products. If you wish, the coupon will also enlist for you the services of a qualified Carey Industrial Sales Engineer. No obligation.

● In the boiler feed pump room, feed water discharge lines and recirculating lines are insulated with 2" thick Carey 85% magnesia insulation. Finish is 8 oz. canvas on rosin sized paper. Boiler feed water suction lines insulated with Carey standard thickness 85% magnesia, finished with 8 oz. canvas over rosin sized paper.



● The main steam lines and stop valve to turbine, where operating temperatures reach a maximum of 905° F., 8" and 12" pipe, insulated with 2" thick Carey Hi-Temp and 2" thick Carey 85% magnesia, finished with ½" Carey asbestos cement, layer of asbestos paper, layer of asbestos cloth sewn on with copper wire.



● View of Arapahoe Station from turbine floor. Elevation 5287'. Workmen are applying 8 oz. canvas to lines.

FILL IN AND MAIL THE COUPON TODAY.

Carey

FROM THE HOUSE OF CAREY—
Insulation • Built-up Roofing • Careystone Roofing and Siding • Careyduct • Asphalt Plank • Asphalt Paints and Coatings • Industrial Flooring • Other Famous Products for Industry

The Philip Carey Mfg. Company, Lockland, Cincinnati 15, Ohio
In Canada: The Philip Carey Co., Ltd., 277 Duke St., Montreal 3, P. Q.

THE PHILIP CAREY MFG. COMPANY
Department PP7
Lockland, Cincinnati 15, Ohio

☐ Please send me latest technical bulletins describing Carey industrial insulation products, and their uses.
☐ Please have a Carey Industrial Sales Engineer call on me.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

WeldELLS

...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

Ask for up-to-the-minute facts about WeldELLS and Taylor Forged Steel Flanges.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

ISA MAINTENANCE CLINIC COMMITTEE: L to r: Bob Joyce, Standard Oil Co. (Ohio); Larry Seigel, Case Tech; John Tufft, Du Pont; Milton McMillen, Thompson Products; Dave Strong, NACA; Ralph Higgins, Diamond Magnesium. Missing when photo was taken: Frank Cochran, Lubrizol; John Kell, C&O RR.

Two Clinics Added Features at 7th National Instrument Meeting

TWO important Clinics will be conducted in connection with the 7th National Instrument Conference and Exhibit this year in Cleveland Sept. 8-12.

In addition to the now regular pre-Conference Instrument Maintenance Clinic during the three days prior to the opening of the show Sept. 5, 6 and 7, a new Analysis Instrumentation Clinic will be held sometime during the week of Sept. 8.

The maintenance clinic, according to Chairman Milton M. McMillen of Thompson Products Co., will be at Case Institute of Technology. The program will include the following general subjects, thermal elements, electrical measuring circuits, pressure elements and primary flow elements, electrical deflection and indicators, total quantity meters, electronic positioning devices, pneumatic positioning devices, final control elements.

Classes of two-hour duration will begin Friday afternoon and continue all day Saturday and Sunday. In addition, the ISA film "Principles of Automatic Control," will be shown at regular intervals. There will also be one general session Friday evening on the principles of instrumentation and automatic control, the speaker will be Dr. D. P. Eckman of Case.

Instead of employing personnel from the staffs of instrument manufacturers, the instructors for this year's clinic have been recruited from the users industries in the great Cleveland industrial area. The clinic committee has received excellent co-operation from industrial groups throughout the area covering such diversified activities as power, steel, non-ferrous metals, chemicals, petroleum, rubber, aircraft research, and colleges.

Sufficient instructors are being provided to take care of about 400 students and every effort is being made to keep the classes as small as possible, within the limits of available facilities at Case.

Dormitory cafeteria, and classroom facilities are being made available on the Case campus. Dormitory rates are $3.00 per night for single rooms, $2.00 per person for doubles. It is expected that meals will be obtainable for about $4.00 per day. Applications for advance registration should be sent to Mr. P. V. Jones, Mgr., Instrument Society of America, Pittsburgh 33, Pa.

The analysis instrumentation clinic will consist of a lecture and demonstration course on complex analytical instruments, according to Dr. Axel H. Peterson, chairman. It will appeal particularly to technicians, chemists, physicists, and engineers, he said. Electronic, optical, and mechanical design features are to be covered as well as details of application.

The instruments to be demonstrated and the participating companies are as follows:

Plant stream analyzer, infrared absorption type—Baird Associates.

Flame spectrophotometer—Beckman Instruments, Inc.

Mass spectrometer leak detector—Consolidated Engineering Co.

Radio-activity instrumentation—General Electric Co.

Thermal conductivity gas analysis—Gow-Mac Instrument Co.

Combustible gas, oxygen and Luft-type infrared analyzers—Mine Safety Appliances Co.

X-ray spectrometer and x-ray fluorescence analysis unit—North American Philips Co., Inc.

Double beam infrared spectrometer—Perkin Elmer Corp.

Light scattering apparatus, differential refractometer, recording spectrophotometer (visible and ultraviolet), and high vacuum manifold—Process & Instruments, Inc.

The program and registration forms may be obtained by writing to Dr. Axel H. Peterson, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

API's Refining Division To Meet In N. Y in '53

THE General Committee of the Division of Refining of the American Petroleum Institute has selected the Commodore Hotel in New York City as the tentative site for its 18th mod-year meeting next spring, subject to approval by the board of directors. The meeting dates are May 11 to 14, 1953.

Decision on the meeting was reached by the committee at this year's meeting held May 12-15 in San Francisco.

Oil Man's Calendar

JULY

National Conference on Clays and Clay Technology, Berkeley Campus, University of California, Berkeley 4, Calif., July 21-25.

AUGUST

Society of Automotive Engineers, West Coast meeting, Fairmont Hotel, San Francisco, Calif., August 11-15.

SEPTEMBER

Instrument Society of America, annual conference and exhibit, Cleveland, Ohio, Sept. 8-12.

American Society of Mechanical Engineers, Industrial Instruments & Regulators Div., Annual meeting, Cleveland, Ohio, Sept. 8-12.

Seventh National Chemical Exposition, The Chicago Section of the American Chemical Society, Chicago Coliseum, Sept. 9-13.

American Society for Testing Materials, conference on engineering, Chicago, Ill., Sept. 10-14.

National Petroleum Assn., 50th anniversary meeting, The Traymore Hotel, Atlantic City, N. J., Sept. 10-12.

American Institute of Chemical Engineers, Former Hotel, Chicago, Ill., Sept. 14-17.

American Society of Mechanical Engineers, Petroleum Division, Annual conference on petroleum mechanical engineering, Hotel Phillips, Kansas City, Mo., Sept. 22-24.

Western Petroleum Refiners Assn., 1952 annual meeting, Benson Hotel, Casper, Wyo., Sept. 25-26.

traps help uncover hidden steam treasure

The facts are these:

A large southern chemical company about a year ago was up to capacity on their boilers. New process units were being added, requiring more steam—a new boiler seemed inevitable.

About that time they began replacing their old-type traps and bleed-off valves with Yarway Impulse Steam Traps and Strainers. Today, even with the new process units added, their daily steam consumption is nearly 100,000 lbs less than a year ago—the superintendent gives Yarway Impulse Traps credit for the saving.

Yarway Impulse Traps are *designed* to insure sending the most premium B.T.U.'s at top temperature into your product or process . . . *to get equipment hotter sooner and keep it hot!*

Yarway's have 11 other advantages, too—such as *small size, low maintenance, low cost, and availability* from over 200 Industrial Distributors. Write for Bulletin T-1740. Or for steam trap advice, call on your nearby Yarway service engineer.

YARWAY

the steam trap designed with more production in mind

YARNALL-WARING COMPANY
153 Mermaid Avenue, Philadelphia 18, Pa.

Refiners' Task: Build Heating Oil Stocks, Meet Current 'Gas' Needs

REFINERS in the U. S. supplied close to normal demand for products during the strike period throughout May by withdrawing material from storage to make up an overall reduction of about one-third in their plant operations. Loss in production is estimated at about 31,000,000 bbls. of gasoline, including natural gas liquids which would have been blended, 3,700,000 of kerosine, 13,000,000 of distillate and 12,500,000 bbls. of heavy fuel oils.

The withdrawals from storage were almost entirely in gasoline, which was reduced by nearly 33,500,000 bbls. from April 26 to May 31, (API data). This compares with a reduction of something over 6,000,000 bbls. in the comparable period in 1951. There was little change in distillate and heavy fuel oil stocks during the strike period, but normally distillates stocks build up several million bbls. during these weeks. See Table 1.

The program for the refining industry, swinging into high gear following the strike, is to build up kerosine and distillates stocks during the coming 15 or 16 weeks to meet the needs of the heating season this winter while at the same time maintaining ample gasoline inventories for current motor fuel requirements.

With the cut of over 33,000,000 bbls. in refinery gasoline inventories during the strike, the total May 31 was approximately 17,800,000 bbls. less than on June 2, 1951. This was because stocks at the start of the strike period stood at the all-time record of over 155,000,000 bbls. They compared with around 146,000,000 bbls. on April 28, 1951.

From June 2, 1951, to the end of the withdrawal period for that year, refinery gasoline stocks were cut by around 20,000,000 bbls. and stood at 119,500,000 bbls. on Nov. 3, 1951. Withdrawals at the same rate this year from the May 21 figure would bring total gasoline inventories in early November to around 101,800,000 bbls., the lowest in several years. During the summer of 1951 some 6,000,000 bbls. of gasoline were taken from refiners' stocks to meet shortages abroad caused by the closing of Abadan refinery in Iran. Such takings are not anticipated this year. Refiners may not be so concerned with the total gasoline stocks at the end of the motoring season as, in individual instances at any rate, keeping working inventories ample for current needs.

Stocks available for heating oils (kerosine and distillates) were practically unchanged during the strike period, as shown in Table 1, while in the same period in 1951 they were increased over 16,000,000 bbls. Last year stocks of kerosine and distillates built up by around 65,000,000 bbls. from their total of 81,138,000 bbls. on June 2, to 146,128,000 bbls. on November 3. To reach that total this November kerosine and distillate stocks will have to build up by over 76,000,000 bbls. from the May 31 total of 70,016,000 bbls. This is an average increase of around 3,000,000 bbls. per week.

Residual fuel stocks showed little change during the strike weeks, and their total on May 31 was about 1,300,000 bbls. less than on June 2, 1951. The stoppage of work in the steel mills of the country is greatly reducing current demand for this refinery product.

Despite the strike in May, by their heavy withdrawals of gasoline from storage, refiners met a demand for motor fuel in that period of close to 3,000,000 bbls. daily, preliminary figures indicate. This amount was approximately 10% below demand in April and also in May, '51. Indicated refinery demand for kerosine and distillate in May was somewhat higher than in May a year ago. Refinery demand for residual fuel was about 20% lower than in April and in May a year ago.

Crude runs in June, for three operating weeks were at rate of around 6,700,000 b/d avg., the highest rate on record and over 2% higher than in June a year ago. Runs for 5 months of '52, including strike period, were about 1% above same period in '51.

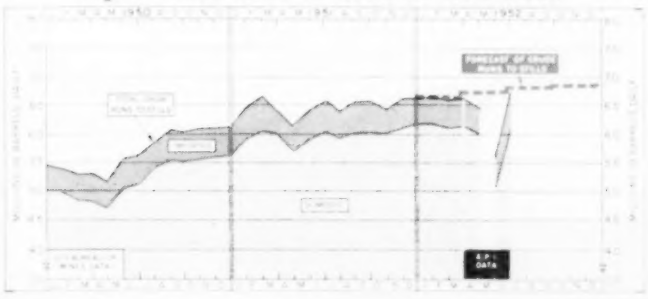
Table 1—Stocks Withdrawals from Refineries of Principal Products During the 1952 Strike Period and Comparable Periods in 1951

(1000 bbls.; API Data, New Basis for Refinery Stocks*)

Date	Gasoline	Kerosine	Distillate	Residual Fuel
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] Stocks of refinery oil stock inventories calculated upon an [illegible] and Revised "Manual of Consistent Classification of Petroleum Statistics," [illegible] Petroleum Administration.

Fig. 1—June Runs to Stills at New Peak



Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Total (1000 bbls.)

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

* Approximate. May estimated from API data.

B/D Forecast of Crude Runs to Stills, 1952

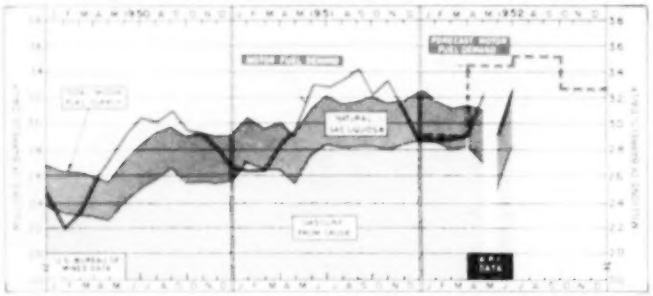
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Yields on Crude Runs to Stills

	Gasoline	Kerosine	Distillate	Residual Fuels
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

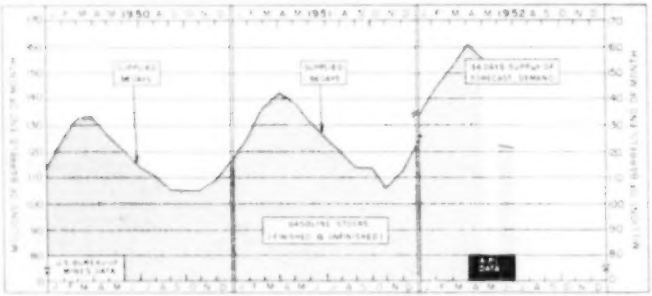
* Preliminary.

Fig. 2—Motor Fuel Output in High Gear



* Natural Gas Liquids include gasoline blended at refineries, and that used as finished motor fuel

Fig. 3—Gasoline Stocks Little Under 1951 Levels



* New basis for reporting added approx. 9,000,000 bbl

Fig. 4—Upward Trend in Heating Oil Output

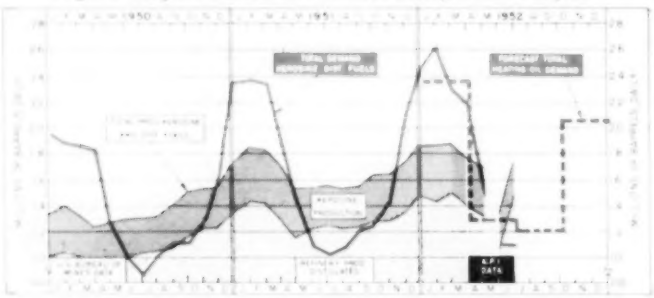
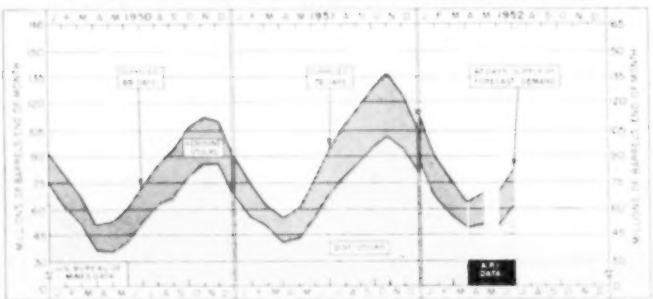


Fig. 5—Heating Oil Stocks in Normal Buildup



* New basis for reporting added approx. 4,500,000 bbl

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
June '52 API*	2,465	105	2,570
June '51 BM	2,547	108	2,655
Change	−138	−3	−141
% Change	−5.4	−2.8	−5.3

* Through June 21

Total (1000 bbls.)
(Bureau of Mines Data)

May '52*	64,847	2,740	67,587
May '51	69,781	2,927	72,708
Change	−4,934	−187	−5,121
% Change	−7.1	−6.4	−7.0

* April and May estimated from API data

Motor Fuel Demand

Including Exports

Daily Average (1000 bbls.)

June '52 API*	2,675
June '51 BM	2,655
Change	+20
% Change	+0.8

* Through June 21

Total (1000 bbls.)
(Bureau of Mines Data)

May '52*	82,925
May '51	82,708
Change	+217
% Change	+0.3

* April and May estimated from API data

BM Forecast of Motor Fuel Demand, 1952

Nov. '51	Dec. '51	1st Q.	2nd Q.	3rd Q.
2,720	2,760	2,480	2,745	2,850

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

June '52 API*	127,611
May '52 API	123,304
April '52 API**	120,240
June '51 BM	127,214

* As of June 21; ** As of April 26

Heating Oils Production

(Kerosene and Distillates)
Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
June '52 API*	160	1,440	1,600
June '51 BM	147	1,214	1,361
Change	+13	+226	+239
% Change	+8.8	+18.6	+17.6

* Through June 21

Total (1000 bbls.)
(Bureau of Mines Data)

May '52*	10,296	89,611	99,907
May '51	9,774	85,234	95,008
Change	+474	+4,377	+4,899
% Change	+5.1	+5.2	+5.2

* April and May estimated from API data

Heating Oils Demand

Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
June '52 API*	190	930	1,120
June '51 BM	149	811	960
Change	+41	+119	+160
% Change	+27.5	+14.7	+16.7

* Through June 21

Total (1000 bbls.)
(Bureau of Mines Data)

May '52*	11,420	200,335	211,755
May '51	9,152	216,847	225,999
Change	+2,268	−16,512	−14,244
% Change	+24.8	−7.6	−6.3

* April and May estimated from API data

BM Forecast of Heating Oils Demand, 1952

Nov. '51	Dec. '51	1st Q.	2nd Q.	3rd Q.
2,100	1,990	1,910	1,470	800

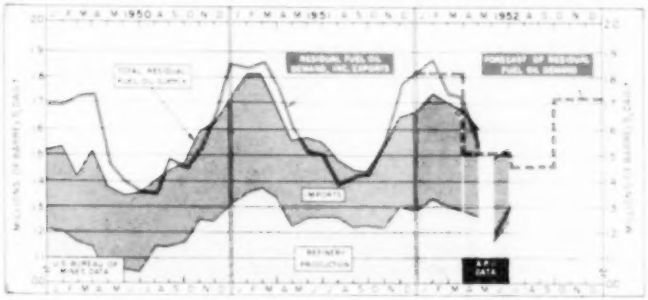
Heating Oil Stocks

(1000 bbls. end of month)

	Kero-sine	Dist. Fuels	TOTAL
June '52 API*	25,860	86,910	112,770
May '52 API	25,460	90,460	115,920
April '52 API	24,140**	91,276	115,416
June '51 BM	28,106	85,930	114,036

* As of June 21; ** As of April 26

Fig. 6—Residual Fuel Output near 1951 Level



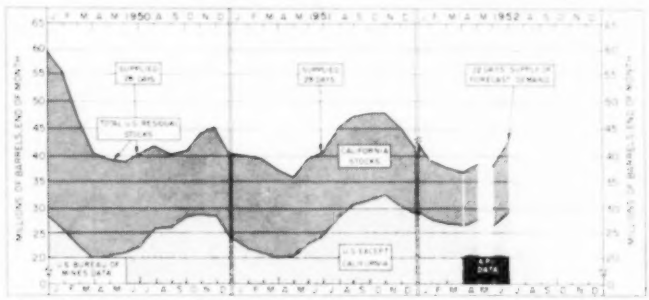
Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
June '52 API*	1,830	271	2,101
June '52 BM	1,827	281	2,108
Change	43	12	55
% Change	2.3	4.2	2.7
Through June 21			
Total (1000 bbls.)			
(Bureau of Mines Data)			
May '52	182,120	57,330	240,322
May '51	199,974	57,029	256,903
Change	-17,854	+301	-16,581
% Change	8.9	0.5	6.5

* April and May estimated from API data

Fig. 7—Residual Fuel Oil Stocks Increasing



* New basis for reporting added approx. 1,500,000 bbl.

Residual Fuels Demand

Daily Average (1000 bbls.)

June '52 API*	1,995
June '52 BM	1,902
Change	-107
% Change	5.1
Through June 21	
Total Demand (1000 bbls.)	
May '52	241,85
May '51	253,663
Change	-14,78
% Change	5.7

May and May estimated from API data

HM Forecast Residual Fuels Demand, 1952

(Nov. 29, 1951 BM avg. by quarters)

1st Q 1,945; 2nd Q 1,995; 3rd Q 1,830; 4th Q 1,725

Residual Fuel Stocks

1000 bbls. end of month

	U. S. Except California	Total U. S.
June '52 API	39,586	42,922
May '52 API	26,024	28,122
April '52 API**	27,830	29,928
June '51 BM	24,910	41,566

* On June 21; ** On April 26

Fig. 8—Production and Demand of Natural Gas Liquids

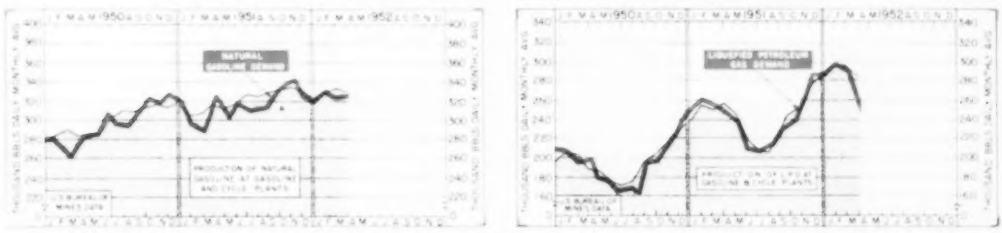
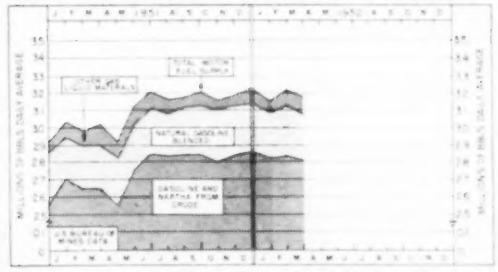


Fig. 9—Makeup of U. S. Motor Fuel Supply



(Figures in table in 1000 bbls. day average)

	Gasoline & Naphtha from Crude	Natural Blended	Other Liq. Liquid Materials	Total Motor Fuel Supply
March '52	2,410	290	120	2,820
Feb. '52	2,420	280	120	2,820
Jan. '52	2,450	270	120	2,840
March '51	2,400	270	110	2,780

Natural Gas Liquids Statistics

Source: U. S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations

	Production* (1000 bbls. day avg.) Natural Gasoline	LPG	TOTAL	Demand** (1000 bbls. day avg.) Natural Gasoline	LPG	TOTAL
March '52	261	260	521	237	264	501
March '51	237	214	451	232	241	473
Change	24	46	70	5	23	28
% Change	10.1	21.5	15.5	2.2	9.5	5.9
Total Production (1000 bbls.)				Total Demand (1000 bbls.)		
Mar. '52	8,090	8,060	16,150	7,347	8,184	15,531
Mar. '51	7,329	6,634	13,963	7,190	7,472	14,662
3 Mos. '52	23,911	23,681	47,592	22,490	23,911	46,401
3 Mos. '51	21,712	19,778	41,490	21,178	21,954	43,132
% Change	10.1	19.8	14.7	6.2	8.9	7.6

Stocks, End of Month (1000 bbls.)

Month	By Type of Product — At gasoline plants and terminals only: LPG	Natural Gasoline	Cor. Condensate	Finished Gasoline	By Location: Gasoline Plants	Refineries	Total
March '52	2,770	2,100	114	1,103	1,137	2,950	4,087
Feb. '52	2,332	2,182	121	1,102	1,017	2,720	3,737
Jan. '52	1,966	2,174	111	1,110	1,047	2,624	3,671

* Production includes casinghead gas, whether or not an outlet producing from natural gasoline and cycling plants. Receipts from refineries in March included 1,000 bbls. of natural gasoline and 5,000 bbls. of naphtha.

** Demand shows quantities of natural gasoline and LPG sold for consumption purposes, which totaled 2,796,000 bbls. in March.

† Includes exports and minor products.

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

●

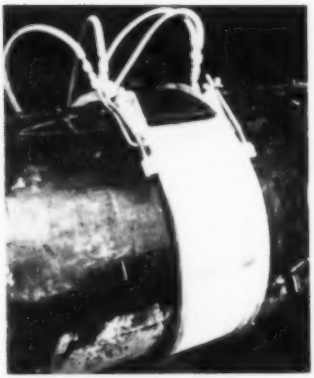
Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

(A1) AIRETOOL MFG. CO., THE ... 1002
(A2) ALLOY METAL WIRE CO., INC. ... 1012
(A3) ALUMINUM CO. OF AMERICA ... 918
(A4) ALUMINUM CO. OF AMERICA ... 1017
(A5) AMERICAN BITUMULS & ASPHALT CO. ... 999
(A6) AMERICAN DISTRICT STEAM CO., INC. ... 920
(A7) AMERICAN LOCOMOTIVE CO. ... 929
(A8) ANACONDA COPPER MINING CO. ... 1001
(A9) BADGER MFG. CO. ... 1015
(B1) BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV., ALLIED CHEMICAL & DYE CORP. ... Inside Back Cover
(B2) BIGELOW-LIPTAK CORP. ... 936
(B3) BLACKMER PUMP CO. ... 1042
(B4) BLACK, SIVALLS & BRYSON, INC. ... 904
(B5) BLACK, SIVALLS & BRYSON, INC. ... 1006
(B6) BYRON JACKSON CO. ... 902
(B7) CANADIAN IRI, COMPANIES, LTD. ... 1040
(B8) CAREY MFG. CO., PHILIP ... 1025
(B9) CARRIER CORP. ... 946
(C1) CHICAGO BRIDGE & IRON CO. ... 1020
(C2) CLARK MFG. CO., THE ... 1004
(C3) CONOFLOW CORP. ... 1041
(C4) CONTINENTAL SUPPLY CO. ... 1001
(C5) COOPER-BESSEMER CORP., THE ... 1013
(C6) CRANE CO. ... 1014
(C7) CRAWFORD FITTING CO., THE ... 1015
(C8) CRISWELL, INC. ... 1000
(C9) DU PONT DE NEMOURS & CO., INC., E. I. ... 924
(D1) DU PONT DE NEMOURS & CO., INC., E. I. ... Facing 941, 943
(D2) DU PONT DE NEMOURS & CO., INC., E. I. ... 1006
(D3) DURAMETALLIC CORP. ... 1024
(D4) ENJAY CO., INC. ... 1008
(D5) ETHYL CORP. ... Facing Inside Front Cover
(D6) EVERLUBE ENGINEERING CORP. ... 1000
(D7) FILTROL CORP. ... 940
(D8) FISCHER & PORTER CO. ... 934, 935
(D9) FLINT STEEL CORP. ... 1021
(E1) FLUOR CORP., LTD., THE ... 1005
(B1) GENERAL CHEMICAL DIV., BAKER & ADAMSON PRODUCTS, ALLIED CHEMICAL & DYE CORP. ... Inside Back Cover
(E2) GLOBE STEEL TUBES CO. ... Facing 930
(E3) GRAVER TANK & MFG. CO., INC. ... 1006
(E4) HARTZELL PROPELLER FAN CO. ... 1016
(E5) HAVE CORP. ... 944
(E6) HOOKER ELECTROCHEMICAL CO. ... 1000
(E7) HUDSON ENGINEERING CORP. ... Inside Front Cover
(E8) INSTRUMENTS, INC. ... 1024
(E9) INTERNATIONAL ENGINEERING, INC. ... 1024
(F1) JOHNS-MANVILLE CORP. ... 1012
(F2) KELLOGG CO., THE M. W. ... 920, 921
(F3) KOCH ENGINEERING CO. ... 934
(F4) LAPP INSULATOR CO. ... 1004
(F5) LUMMUS CO., THE ... 926
(F6) METAL TEXTILE CORP. ... 1010
(F7) MINNEAPOLIS-HONEYWELL REGULATOR CO. ... 910, 911
(F8) MONSANTO CHEMICAL CO. ... 909
(F9) NATIONAL AIROIL BURNER CO. ... 1012
(G1) NICHOLSON & CO., W. H. ... 1016
(G2) NORDSTROM VALVE DIV., BOCKWELL MFG. CO. ... 905
(G3) NORTON CO. ... Facing 928, 929
(G4) OAKITE PRODUCTS, INC. ... 1011
(G5) O'DONNELL, JAMES P. ... 1012
(G6) OIL WELL SUPPLY CO., U. S. STEEL CORP. ... 900
(G7) ORBIT VALVE CO. ... 897
(G8) PACIFIC PUMPS, INC. ... 933
(G9) PENBERTHY INJECTOR CO. ... 941
(H1) PETRO-CHEM DEVELOPMENT CO., INC. ... 993
(H2) PETROLEUM PROCESSING ... 921, 923
(H3) PITTSBURGH LECTRODRYER CORP. ... 1039
(H4) POWELL CO., THE WM. ... 1018
(H5) PROCON, INC. ... 902
(H6) REDIC TOOL CO., THE ... 1045
(H7) ROOTS-CONNERSVILLE BLOWER CORP. ... 916
(H8) SELAS CORP. OF AMERICA ... 929
(H9) SHELL OIL CO. ... 943
(I1) SHERWIN-WILLIAMS CO., THE ... 1000
(I2) SIMS PUMP VALVE CO. ... 1038
(I3) SONNEBORN SONS, INC., L. ... 1001
(I4) SWARTWOUT CO., THE ... 928
(I5) TAYLOR FORGE & PIPE WORKS ... 1026
(I6) TAYLOR INSTRUMENT CO. ... 922
(I7) TENNESSEE EASTMAN CO. ... 939
(I8) THERMO-ELECTRIC CO., INC. ... 1043
(I9) TRANE CO., THE ... 931
(J1) U. S. STONEWARE CO. ... 1017
(J2) UNIVERSAL OIL PRODUCTS CO. ... 942, 944
(J3) VATOR DEWATERER SYSTEMS CO. ... 939
(J4) VISKING CORP. ... 937
(J5) VOGT MACHINE CO., HENRY ... 912
(J6) VULCAN COPPER & SUPPLY CO. ... Facing 927
(J7) WARNER LEWIS CO. ... 1039
(J8) WATSON-STILLMAN CO. ... 912
(J9) WESTERN SUPPLY CO. ... 939
(K1) WESTINGHOUSE ELECTRIC CORP. ... 908
(K2) WOLVERINE TUBE DIV., CALUMET DECTA CONSOLIDATED ... 1040
(K3) WYATT METAL & BOILER WORKS ... Outside Back Cover
(K4) YARNALL-WARING CO. ... 1028
(K5) YOUNG RADIATOR CO. ... 1022

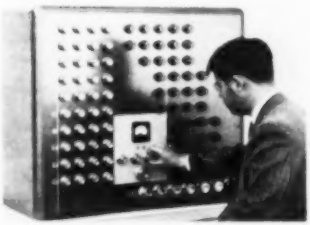
WHAT'S NEW . . .



X-Ray Method Aids Inspection Of Partially Completed Welds

"Hot radiography" permits the taking of X-Ray photographs of large pipes, valves, and similar units at temperatures as high as 1200° F. Known as the McElroy-McNutt hot radiography process, the method has been applied with considerable success to the inspection of partially-completed welds on hot sections of pipe for possible welding defects. Radiography involves taking a picture of a material by placing sensitized film on one side and a source of X-Rays or gamma rays at the opposite side. With the ordinary technique, before the film can be placed on the weld, the pipe section must be cooled down to about 100° F. With certain types of alloys, this cooling must be preceded by post-heating the weld to relieve internal stresses. Because of the lengthy cooling period involved, the usual practice has been to complete the weld before inspecting it. Hot radiography can be accomplished on a hot pipe and makes it practical to interrupt the welding operations to inspect the weld root where most flaws occur. In the process a cooling fluid, circulating through the hollow chambers of the holder, protects the film emulsion from the heat of the welded section. This technique, therefore, saves the many man-hours of heating and controlled cooling that were formerly required before the weld could be inspected. Additional time is saved because, if defects are found, it is necessary to chip away only a partially-completed weld rather than a finished weld. The technique can also be used for radiography of other forms of hot metallic materials. Sam Tour & Co., 44 Trinity Place, New York 6, N. Y.

Circle No. 1 on Reply Card



Portable Computer Calculates Flash Equilibrium Equations

The "Phase Equilibrium Computer" has been developed to solve complex flash equilibrium equations in three to four minutes. The instrument has a wide range of applications in designing fractionators, absorbers and other refinery equipment, quickly and accurately evaluating the interaction of gas and liquid phases with temperature and pressure variations throughout the columns. The manufacturer claims that it saves valuable time in designing surface separator systems for optimum operating temperatures and pressures, assuring maximum recovery of the desirable constituents. The computer is portable and operates directly from 110 volt A. C. current requiring no special circuits. Operation of the computer is quite simple. Data consisting of analyses of the feed, together with equilibrium constants for the given temperatures and pressures, are set into the machine by means of numbered decade dials. Dials are adjusted to balance the network as indicated on a null-indicating meter, and thence the ratio of total liquid to total vapor is solved. Subsequent balances solve the liquid fraction of each constituent and the vapor feed ratio. Accuracy for each constituent is within 0.05% of the total liquid, it is claimed. Beckman Instruments Inc., South Pasadena, Calif.

Circle No. 2 on Reply Card

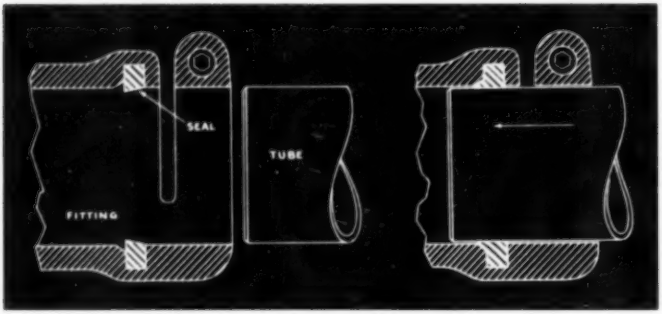
Audigage Accessory Aids In Ultrasonic Thickness Tests

A new magnetic fixture for use with the ultrasonic "Audigage Thickness Tester" has been developed for use when test points are beyond easy reach, such as fractionating columns, bottoms and sides of storage tanks. This accessory assures good contact and prevents accidental shifting of the searching unit during tests. The fixture consists of a flat spring with an "Alnico" permanent magnet coupled flexibly to each end, and means for attaching the searching unit quickly to its center. Standard magnets are of sufficient strength to hold the unit properly against surfaces that are slightly irregular or covered with a thin coat of paint; heavier magnets can be provided for use on cast iron and other rough surfaces or on plates that are covered with thick coatings of paint or scale. The standard fixture is only 5-in. wide and weighs 6 oz. Branson Instruments, Inc., 120 Fairfield Ave., Stamford, Conn.

Circle No. 3 on Reply Card

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage required.



Fitting Permits Rapid Assembly

"Quikupl," a simple new design in stainless steel fittings for use in the 150 psi. range, can be joined to tube or pipe without threading, flaring, sweat soldering, brazing, beading, or welding. The fitting has been designed to reduce assembly costs, and to permit the use of less expensive light wall tubing.

Its use is illustrated in the drawings. The pipe or tube is cut to proper length, deburred, and then inserted into the fitting. The joint is completed by tightening a small screw.

With no threading needed, lighter walled tube can of course be used thus escaping the cost of the heavier walls required to take threads. Where thin wall tubes are already being used, costs are saved in eliminating flaring, welding, etc.

In appearance, as shown in the photograph, the Quikupl fittings resemble standard shapes, with the addition of a clamp which is an integral part of the unit. The only tool needed to complete an assembly is a hex wrench for the set screw. The neoprene seal ring is constructed so it maintains a squeeze fit within commercial stainless tube or pipe tolerances.

Inventories can be simplified with the new fitting. It can be used with schedules 5, 10, 40 and 80 pipe sizes without changing from one fitting to another. The only requirement is constant O. D. The fittings are now available in 1 to 4-in. sizes, in tees, elbows, couplings, reducers, and adapters. Cooper Alloy Foundry Co., Hillside 5, N. J.

Circle No. 4 on Reply Card

Centrifugal Pump Design Uses Modern Hydraulic System

A redesigned line of horizontal multistage centrifugal pumps for medium-pressure applications incorporates modern hydraulics to obtain higher efficiency and better operation. These pumps, called "Class CNTA," are intended for boiler-feed, mine dewatering, marine, refinery and general industrial services to 800 psi. Built in 1½, 2, 2½, and 3-in. sizes, units are available with 4, 6 or 8 stages. The pumps feature a horizontally-split, smooth-bore, cylindrical casing which contains the unit-type rotor assembly, which is composed of the shaft, impellers, and channel rings. The entire rotor assembly is quickly and easily removed from and installed in the casing. Radial thrust is eliminated at all conditions of operation. Back to back grouping of the impellers neutralizes axial thrust developed by the pressure differential across each individual stage. The interstage sealing method utilizes an alloy cast iron or stainless steel piston ring around the outer diameter of each individual channel ring. These hydraulic-type step-seal rings have a metal-to-metal fit with the casing and are automatically placed under the correct compression when the casing halves are bolted together. The "Cameron Shaft-Seal" may be installed in these pumps where difficult liquids are encountered. Water-cooled stuffing boxes are standard on pumps with steel casings and can be provided with cast-iron construction if requested. Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

Circle No. 5 on Reply Card

Paint Withstands 1600° F. Heat And Bonds Metal Surfaces

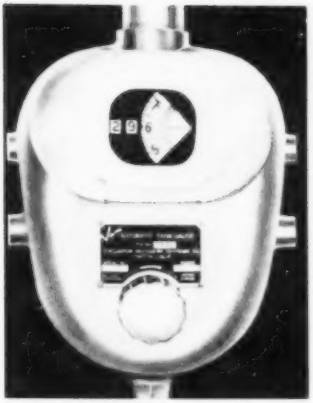
"Super-Hot" is a new ready-mixed aluminum paint that, when applied to practically any metal surface, permanently bonds to the surface after subjecting it to heat from 500 to 1600° F. The manufacturer guarantees unconditionally that the paint will maintain its brilliance and will not crack, chip or peel. Thermocoupling action promoted by the application of heat in excess of 800° F to a metal object painted with Super-Hot makes the painted object impervious to most ordinary solvents. This is due to the transition of the paint from a peripheral coating of paint to an aluminum glaze that is an integral exterior of the painted object. It may be brushed, sprayed or dipped, and air dries within 30 minutes, after which time heat can be applied. The paint may be applied to rusty surfaces, moderately greasy or oily, although best results are obtained when application is made on clean, dry surfaces. Sheffield Bronze Paint Corp., 17814 Waterloo Rd., Cleveland 19, Ohio.

Circle No. 6 on Reply Card

Tube Attachment Increases Spectrophotometer Sensitivity

A new "Photomultiplier" attachment has been developed which increases the sensitivity of the Beckman Model DU Spectrophotometers—particularly in the 200 to 600 millimicron range. The device permits obtaining an overall amplification gain from 100 to 1000 times that of the standard ultraviolet sensitive phototube. Resolution of the instrument is increased in all measurements but particularly in flame, fluorescence, and turbidimetric determinations. The attachment is simple to install and no instrument modification is necessary. It consists of an auxiliary battery box equipped with all required dry cells eliminating need for batteries in the bottom of the Model DU Monochromator; and a specially-arranged phototube housing containing the 1P28 multiplier phototube. Beckman Instruments, Inc., South Pasadena, Calif.

Circle No. 7 on Reply Card



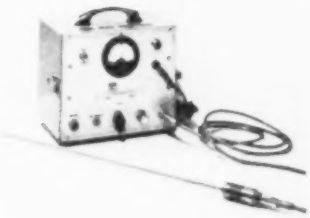
Tank Level Readings Simplified By Use of Automatic Gauge

Designated as the Figure No. 2500, an automatic liquid level gauge incorporates a full-view, direct reading counter in the look box for quick, accurate reading of foot increments and a dial for reading inches and fractions of contents in low pressure storage tanks. The need for conventional counterweight is eliminated by using a patented "Negator" motor, housed with the gauge head, which maintains a predetermined constant tape tension. Other features include: 1) installation of look box at any desired height, 2) adaptable to all arrangements and types of low-pressure tanks up to 70 ft. in height, 3) gas-tight look box adaptable for installation on existing float operated automatic tank gauges utilizing 7-in. wide tape sheaves, 4) patented gravity compensator incorporated with "inch reading" dial, permitting adjustment in the look box to correct any error in reading due to gravity change of product, 5) design permits installation at any later date of "VAREC" electronic transmitters for use with remote reading gauger receivers, 6) available for metric measurement. The Vapor Recovery Systems Co., Compton, Calif.

Circle No. 8 on Reply Card

Combustion, Flame Propagation Can Be Studied with Flamometer

Now available is a new instrument designed to detect, amplify and indicate electrical signals generated by turbulent flames, in the audio frequency range. The "Flamometer" is expected to be an excellent tool for locating flame zones and boundaries. It consists of a detecting probe ceramic tip supported by a metal rod and an electrical circuit. No significant signal is registered unless the probe is in an actual flame zone which is both ionized and turbulent. Response time is of the order of a millisecond. The signal from the probe is fed to an electronic amplifier with gain control, which allows the instrument to be used on different type flames. The amplifier output can be observed or used in the following manners: 1) output can be read from the meter on the Flamometer instrument panel, 2) the output can drive a 0-1 ma. pen recorder, 3) the signal can be followed on an oscilloscope or 4) the output can be used to actuate relays or a servo-mechanism. Probes have been designed to withstand a wide range of mechanical or thermal loads over long periods of time. The first two stages of the amplifier are shock-mounted to minimize microphonic interference. These features are most useful for the study of combustion and flame propagation. Phillips Petroleum Co., Instruments Div., Bartlesville, Okla.



Circle No. 9 on Reply Card

DID YOU MISS THESE?

The following items, reviewed originally in the May issue, have aroused considerable interest. They are repeated briefly as a service to those who might have missed them the first time. For details or literature, use the regular Reply Card in this issue.

New Centrifugal Pump Works By Vibration, not Rotation

Essentially a centrifugal pump, the new "Vibro-Pump" employs principles of vibration rather than rotation. It will handle liquids containing up to 20% vapor without loss of efficiency. It is comprised of three parts: 1) a slightly curved shaft extending from a motor coupling, 2) a single unit consisting of the impeller housing and a vane, and 3) the pump housing. Impressed on the curved shaft is a permanently lubricated frictionless bearing which is permanently sealed in the metal bellows or rubber impeller housing and vane unit. As the shaft rotates, it imparts to the vane an orbital motion. A wave-shaped vane remains in a horizontal plane, scooping the liquid from the pump center and pushing to the housing perimeter. The pump is hermetically sealed, making it applicable to handling chemicals, oil, gasoline, etc. In water tests, a pump with a 1½ in. housing and 1-in. impeller orbit, powered by a 1.25 hp. motor at 4000 rpm. developed a head of 35 ft. A 3-in. pump powered by a 1.6 hp. motor at 3600 rpm. created a suction of 27 in. Hg. Bennett Productions, 1507 Walnut St., Phila. 2, Pa.

Circle No. 10 on Reply Card

Ultrasonics Are Employed in New Recording Viscosimeter

The "Ultra-Viscoson" employs ultrasonic principles to measure and record viscosities continuously and automatically. An hermetically sealed probe, the size of a fountain pen, it contains no moving parts and operates to 650° F., 10,000 atm. pressure and can be installed permanently in pipe, process vessels, or used in test tubes and beakers. An electronic computer, which can be located up to 1 mile from the probe, indicates viscosity of Newtonian materials from 0.50-5000 centipoises x gms./cc. in four decades, 0.50, 5.00, 50.00, 500.000. Apparent viscosity of non-Newtonian materials can be measured over a much greater range. Rich-Roth Laboratories, 675 Connecticut Blvd., East Hartford 8, Conn.

Circle No. 11 on Reply Card

Water Conditioning Handbook

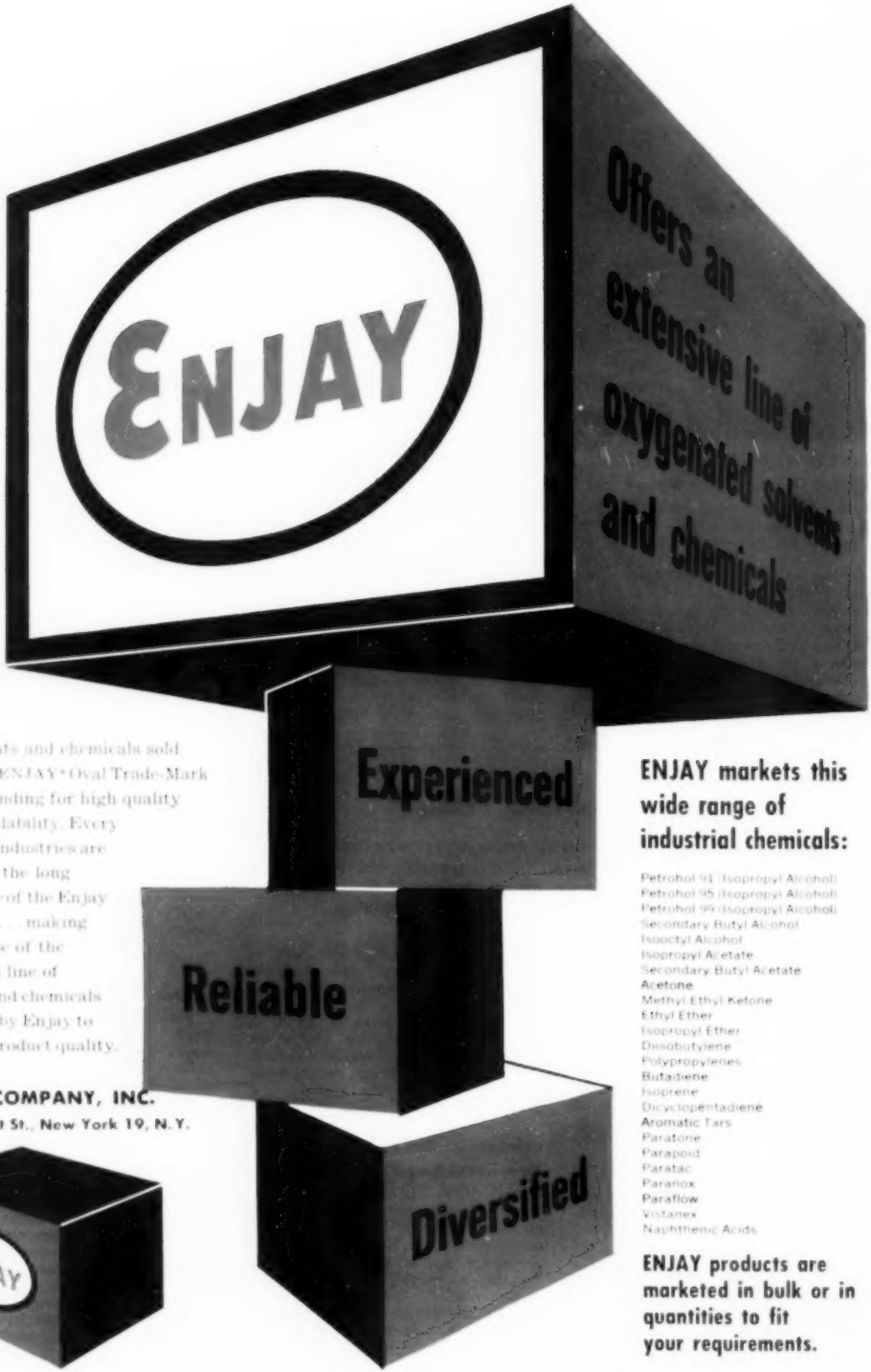
Permutit Water Conditioning Data Book, 116-page, leatherette bound book, covers hydraulics, impurities, chemicals used, specific gravities, and chemical reactions; supersedes a 1949 volume. Permutit Co., 330 W. 42nd St., New York 36, N. Y.

Circle No. 12 on Reply Card

Basic Process Control

Fundamentals of Instrumentation for the Industries, Bulletin No. 80-2, 128-page booklet covering measurement, control, and transmission of variables encountered; with typical applications, drawings, and photographs. Minneapolis-Honeywell Regulator Co., Brown Div., Wayne and Windrim Aves., Phila. 44, Pa.

Circle No. 13 on Reply Card



The solvents and chemicals sold under the ENJAY* Oval Trade-Mark are outstanding for high quality and dependability. Every day more industries are calling on the long experience of the Enjay Company . . . making greater use of the diversified line of solvents and chemicals marketed by Enjay to increase product quality.

*Trade Mark

ENJAY COMPANY, INC.
15 W. 51st St., New York 19, N.Y.

ENJAY markets this wide range of industrial chemicals:

Petrohol 91 (Isopropyl Alcohol)
Petrohol 95 (Isopropyl Alcohol)
Petrohol 99 (Isopropyl Alcohol)
Secondary Butyl Alcohol
Isooctyl Alcohol
Isopropyl Acetate
Secondary Butyl Acetate
Acetone
Methyl Ethyl Ketone
Ethyl Ether
Isopropyl Ether
Diisobutylene
Polypropylenes
Butadiene
Isoprene
Dicyclopentadiene
Aromatic Tars
Paratone
Parapoid
Paratac
Paranox
Paraflow
Vistanex
Naphthenic Acids

ENJAY products are marketed in bulk or in quantities to fit your requirements.

Regulator Holds Set Flow Rate Despite Fluctuations in Lines

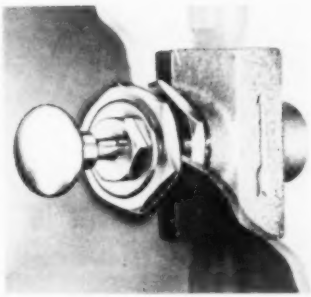
Designed for use wherever liquids are handled, a new flow regulator is well-adapted to such jobs as blending and proportioning, solvent extraction, controlling filter effluent, water treatment and deionizing, chemical process control, evaporator influx, and diluting of bulk heavy chemicals. A calibrated dial is set to the desired flow rate and despite pressure fluctuations in either inlet or outlet lines, the flow is automatically held to the set rate. Available with standard capacities ranging from 0.1 to 100 gpm of water, all models are accurate to ±3%. Installation requires no special tools and can be made quickly. W. A. Kates Co., Deerfield, Ill.

Circle No. 14 on Reply Card

Batch Samples Ultracentrifuged Up to 43,380 Times Gravity

Batch samples as large as 1600 ml. can be ultracentrifuged up to 20,000 rpm under controlled temperature conditions in a new bowl-type rotor designed for use with the "Model L Preparative Ultracentrifuge." At this speed the material is subjected to maximum and minimum centrifugal forces of 43,380 and 16,770 times gravity, respectively. The rotor has been designed to speed up preparative runs on sedimenting materials which pack readily, particularly those forming gelatinous precipitates. Rotor consists of: 1) main bowl with two internal grooves dimensioned for efficient material packing and for easy resuspension of packed materials, 2) removable central core which prevents sloshing, minimizing unbalance and stir-back, 3) lid-handle assembly. The core includes two filling holes with plugs for which can be substituted plastic discharge tubing arranged for easily-controlled discharge of the supernatant fluid. Packed sediment is extracted with a plastic scraper or resuspended by use of stainless steel balls and a motor-driven rolling fixture which is an accessory. To facilitate recentrifuging after this operation a magnet is supplied for withdrawing the balls without removing the center core. Weighing approximately 22 lbs. loaded, the new rotor accelerates to 20,000 rpm; maximum routine operating speed, in nine minutes. Specialized Instruments Corp., 623 O'Neill Ave., Belmont, Calif.

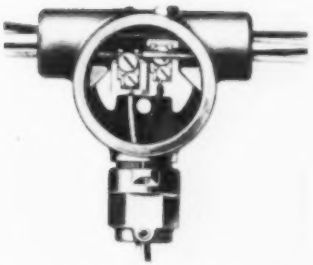
Circle No. 15 on Reply Card



Air and Gas Spurts Controlled In Lines by New Push Valve

The "Self-Closing Push Valve" has been developed for use in gas and air lines where manual control of an intermittent flow is required and where there must be no leakage through the valve or around the valve stem. The valve is available in two styles: Model PV (illustrated), for mounting on panels of any thickness up to 7/16 in., and Model LV for in-the-line mounting. Inlet and outlet are tapped for ¼ in. pipe, and direction of flow is shown by an arrow. Discharge rate is 25 to 30 cu. ft. min. at a pressure drop of 100 psi. Typical applications include use with hydrostatic gages and other instruments requiring a manually-controlled blast of air; use with single- and multiple-pressure test stands; blowing out or purging of gas or air lines; and use with processing operations requiring an occasional spurt of gas or air. The valve is opened by pressing a knob on the valve stem, and closes automatically when the knob is released. It has no compression packing and requires no adjustment, being sealed by neoprene O-rings. The rings are readily accessible by removing a nut and lifting out the valve stem. Breakdown tests showed no leakage after 1 million cycles of operation. King Engineering Corp., Ann Arbor, Mich.

Circle No. 16 on Reply Card



Explosion-proof Fixture Hanger Meets Underwriters' Codes

A new explosion-proof fixture hanger meets the requirements of Underwriters' Laboratories Inc. and the National Electrical Code. Type EFHC hanger is essentially a T-fitting, the top through-feed hubs being for the lighting circuit conduit and the bottom hub for the fixture stem. A threaded cover is provided at the side of the hanger so that it directly faces the installing electrician. The fixture stem may be threaded into the bottom hub of the hanger without the risk of twisting the connecting wires before connection is made to the circuit wires. The hanger

Do YOU have CORROSION TROUBLES?

ALMET 430 SOLVES THE PROBLEM!

Use ALMET 430 Stainless Steel wire and bands on your tower, tank, processing vessel and pipe insulations. No worry of the bands deteriorating resulting in expensive downtime and lost production.

ALMET 430 is available in .045" and .065" diameter wire or in strips .015" and .020" thick and widths of ⅜" to 1¼" and other sizes to suit your needs. Our Engineers are always ready to assist you.

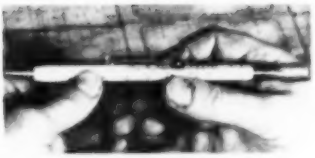
NO PRIORITY NEEDED!
IMMEDIATE DELIVERY!

For information and prices call or write
ALLOY METAL WIRE CO., INC.
PROSPECT PARK, PA.
BOX P-1

(To obtain more data on advertised products see page 1032)

is available with either plain hub or union hub for the fixture stem. Both types of hubs are provided with set screws to prevent the fixture stem loosening from vibration. Crane-Hasle Co., 1347 Wolf St., Syracuse, N. Y.

Circle No. **17** *on Reply Card*



Ten Functions Can Be Handled With Writing Slide Rule Device

A unique pencil device, the "Writing Slide Rule" has been developed to enable its user to do practically everything but peel potatoes. Among the ten functions combined in this handy instrument are a telescoping measuring scale, a reading magnifier, a depth gauge in inches and centimeters, a detachable straight-edge, concealed eraser and spare pencil leads, a plain and enlarging indicator for the slide rule's A, B, C, D, L, S, T, CM, and IN scales, and an attractive, functional, optical pocket-clip. Accuracy to the third significant figure is obtained in slide rule calculations. The device is 6½ in. long and weighs 0.8 oz. It is constructed to withstand normal abuse in the classroom, drafting room, laboratory, office, shop, or even in the vest pocket. Its two point construction allows for writing in two colors. Device Development Co., 226 W. Fourth St., New York 14, N. Y.

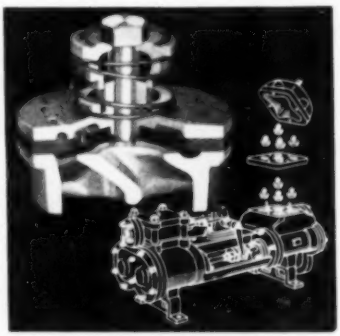
Circle No. **18** *on Reply Card*

New Karl Fischer Reagents Offered in Small Quantities

With many of today's laboratory trends finding more extensive use for Karl Fischer techniques, a primary standard has now been made available in quarter pound, pound and five pound lots. Identified as S-435 Sodium Tartrate Dihydrate, the reagent is extremely stable, even in high humidities, and can be kept for long periods without special storage precautions. It can be quantitatively titrated to a sharp end-point, varying not more than ±0.05% from theory. Available in pound, five pound and gallon lots is D-37 Methylene Chloride, important as a non-flammable solvent and in manufacturing many organic compounds. M-282 Methyl Cellulose, N. F., 1500 Centipoise, rounds out the range of available methyl cellulose viscosity types. It is designed for maximum viscosity with minimum solids such as the stabilization of emulsions. M-282 is available in pound and five pound lots. The demand for two chemically pure cerium salts in spectrographic studies has been met by C-252 Cerium (ous) Chloride, C. P., and C-260 Cerium (ous) Oxalate, C. P., are available in ounce and quarter-pound quantities. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **19** *on Reply Card*

HOW TO *Improve* PUMP PERFORMANCE *and Cut Costs*



Install Sims Pump Valves in your pumps and

(1) **Prevent stem and spring breakage.** Exclusive double shock absorber built into Sims Valves stops opening impact damage.

(2) **Stop wear.** Long guide of rotator prevents cocking of disc and assures even opening.

(3) **Keep seating surfaces leak free.** Sims guarantees the valve disc will rotate . . . and without mechanical friction . . . every time it lifts. It's cushioned top and bottom by liquid while it rotates. Wears uniformly all the way around.

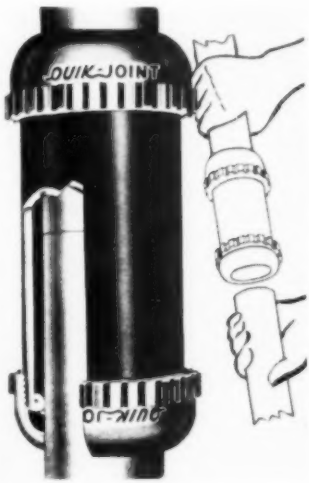
(4) **Stop valve slam and knock.** Quiet operation is gained by cushioning moving parts and cutting resistance to flow through the **seat**, with patented **inclined ribs**. **Reduced resistance** means **increased pump capacity**—a 20% increase.

WRITE FOR NEW CATALOG

New spiral bound catalog shows how they fit your pump . . . with efficiency and comparison charts. Send for free copy today.

SIMS PUMP VALVE CO., INC.

145 HUDSON ST., NEW YORK 13, N. Y. • M & M BLDG., HOUSTON, TEXAS

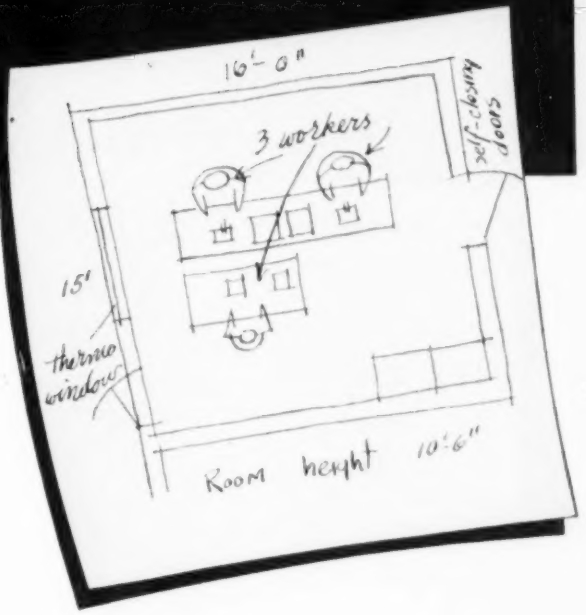


Coupling Works to 2000 psi, Requires No Thread Cutting

A factory assembled pipe coupling which can be installed in any piping system in the smaller diameters in less than 60 seconds requires no thread cutting. Pipes to be connected are simply inserted into the ends of "Quik-Joint" coupling body and the lock nuts wrenched to desired tightness. The result is a tightly sealed but flexible joint capable of withstanding working pressures up to 2,000 psi. No castings are used and the body is of pressure-tested pipe steel having a greater wall thickness than the pipe to be joined. Lock nuts and gasket retainers are drawn from cold rolled steel. The compression rubber gasket comes in a number of formulae depending upon the desired application. Quik-Joint is available in sizes from ½-in. to 1½-in. I. P. S. as straight coupling, 90° and 45° ells, welded and threaded adapters. Special lengths and bends to specification are also available. Quik-Joint Mfg. Co., Harvey, Ill.

Circle No. **20** *on Reply Card*

This was Lectrodryer's proposal for keeping a workroom DRY



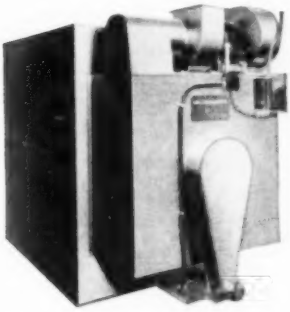
the Problem:

A room 16' x 15' x 10½' is to be held at 20% to 25% relative humidity at a dry bulb temperature of 85° F.

Three people will work in this area. Materials processed give off no moisture. Loss of air from the room will be small.

the Solution:

The Type CHG air-conditioning Lectrodryer®, capable of delivering 350 cfm of DRY air at 15° above temperature of the cooling water, with reactivation heat supplied by fuel gas, electricity or 110 psig steam.



Lectrodryer engineers tell you exactly what equipment you'll need for dehumidifying an area, as they did in the actual case cited above. And, in addition, they advise on methods of sealing openings and walls against the intrusion of moisture — so necessary to hold down your operating costs.

Lectrodryers come to you fully assembled. You have only to connect up supply lines and ducts, and they're ready for work. If you'll tell us your humidity problem, we'll recommend a solution. Pittsburgh Lectrodryer Corporation, 332 32nd St., Pittsburgh 30, Pennsylvania.

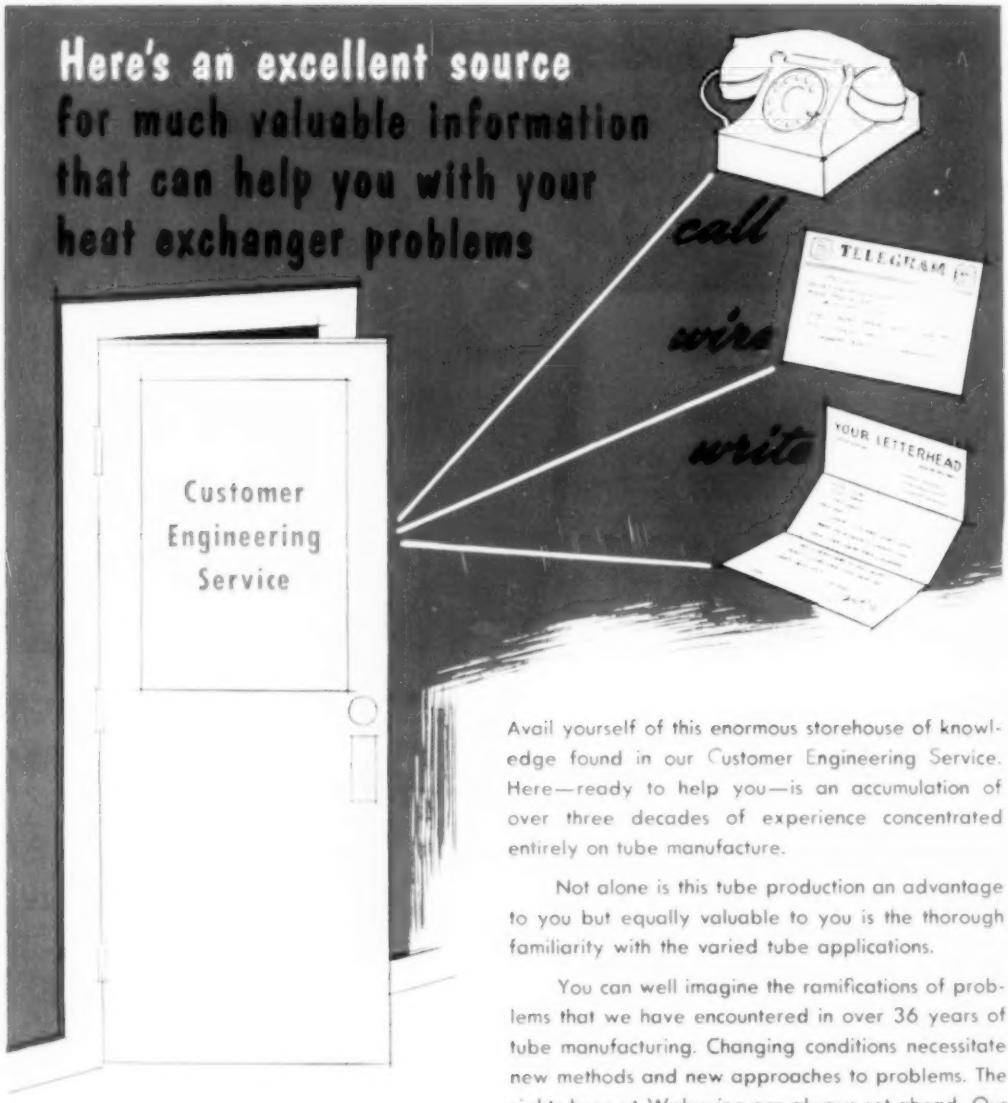
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U.S. PAT. OFF.

Here's an excellent source for much valuable information that can help you with your heat exchanger problems



Avail yourself of this enormous storehouse of knowledge found in our Customer Engineering Service. Here—ready to help you—is an accumulation of over three decades of experience concentrated entirely on tube manufacture.

Not alone is this tube production an advantage to you but equally valuable to you is the thorough familiarity with the varied tube applications.

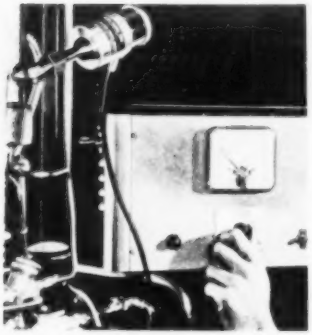
You can well imagine the ramifications of problems that we have encountered in over 36 years of tube manufacturing. Changing conditions necessitate new methods and new approaches to problems. The sights here at Wolverine are always set ahead. Our technicians are always ready for you with the best answers that will improve your efficiency in operation.

Let us relieve you of some of the problems dealing with heat exchangers, condensers, etc.

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
Manufacturers of seamless, nonferrous tubing
1425 CENTRAL AVE. · DETROIT 9, MICH.

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.



Vacuum Gauge Is Self-Cleaning, Detects Extreme Low Pressures

Capable of reading vacuums from 0.50 mm. to 10⁻¹⁰ mm. Hg, the new type PHG-09 gauge covers a range of 8,000,000,000:1 on a single pick-up. The all metal pick-up tube which handles this range, works on the glow discharge principle. In the tube, permanent magnets provide a field which lengthens the electron paths into tight spirals that give high ionization per electron with a cascade effect. Having no filament to burn out, the new tube can be operated at full atmosphere without damage. In addition, the circuit is insensitive to fluctuations in line voltage. Because the magnets are external to the ionization chamber, there is no problem involved with outgassing the magnets or removing stray iron particles. The tube is automatically self-cleaning. When operated at higher pressures in the lowest sensitivity range, it rids itself of deposited film. Vacuum Equipment Department, Distillation Products Industries, Ridge Rd. West, Rochester 3, N. Y.

Circle No. 21 on Reply Card

Leak-proof Seal Eliminates Need For Springs and Counterweights

"HydroSeal," a leak-proof, movable seal for all pressures and strokes, can be incorporated in the design of pneumatic and hydraulic motors, glands, shaft seals, valve seals, cylinders, pumps, brake mechanisms and other devices. It is presently being manufactured in natural rubber, Buna-N, Butyl and other synthetics designed to meet special applications. Similar to conventional diaphragm construction, the HydroSeal also embraces a circumferential holding method which utilizes a peripheral bead for pressure tightness. Substantially a cylindrical form of rubber it will stretch, rather than flex as in the diaphragm. In this stretching the stroke is readily designed into the HydroSeal. Since it is always supported by metallic backing, i. e., the piston or ram, there is no tendency for the seal to rupture. Therefore, high pressure equivalent to those pressures used on pistons, can be applied. By variations of the wall thickness or varied compounding of the rubber-like material, the HydroSeal can be designed with given rate for return strokes, eliminating springs, counterweights and other devices designed to return the piston or diaphragm to a beginning position. The Farris HydroSeal Corp., 533 Commercial Ave., Palisades Park, N. J.

Circle No. 22 on Reply Card

Aircraft Type Fittings Now Offered for Aluminum Tubing

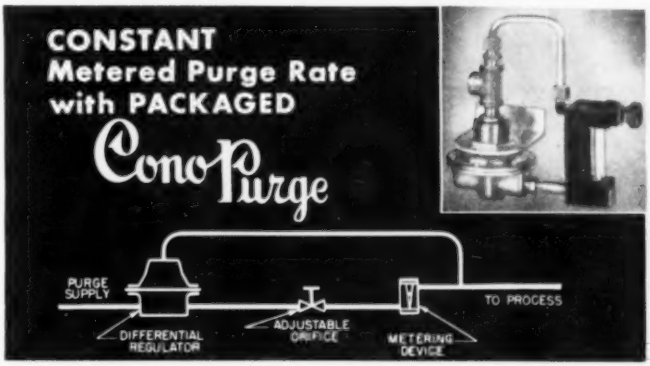
To meet the growing use of all-aluminum tubing systems for fluid handling and low pressure air and oil hydraulics—for example, instrument piping in petroleum and petrochemical plants—Parker Appliance Co. is now producing its "Triple-lok" tube fittings in the light metal as standard items for distributors stocks. The line of fittings, available for the first time for industrial rather than aircraft applications, includes male and female connectors, ells, tees, union and tube end reducers for ⅛, 5/16, ¼, and ⅜ outside tubing. The Triple-lok design is a 3-piece, flared, leakproof model already proved out in brass, steel, and stainless. Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

Circle No. 23 on Reply Card

Mercury Switch Developed for Safe Use in Explosive Areas

A hermetically-sealed mercury switch has been developed for positive safety in hazardous, explosive locations. Mounted on a lever-operated armature, the heart of the unit, the switch is set in operation by a selector knob or push-button which inclines the armature, thereby actuating the mercury switch. Any possibility of a spark is eliminated because of the all-mechanical nature of the actuating linkage. Designed for vertical panel mounting, the switch is a single-pole, with either single or double-throw action. On all push-button models a spring action is featured which returns the switch to original position when the finger pressure is released. It can be set at any time in either "on" or "off" position. Tigerman Engineering Co., 4332 North Clark St., Chicago 26, Ill.

Circle No. 24 on Reply Card



No supervision needed at installation: only two pipe connections required. By providing absolute control of differential pressure across an adjustable orifice, Cono Purge assures constant rate of flow regardless of variations in upstream or downstream pressures. Primarily for use as a purging system on flow metering service or on bubble type level gauges in chemical plants, paper mills, breweries and other industries where suspended matter or corrosive fluids must be kept out of meters and meter piping. BULLETIN H-11 shows how it works. Write for your copy today.

CONOFLOW CORPORATION
2100 ARCH ST.
PHILADELPHIA 3, PA.

Cono-Controls

(To obtain more data on advertised products see page 1032)

Take-offs in Plastic Piping Easy With New Insert Couplings

Insert-type ell and tee couplings have been developed to facilitate making sharp turns or take-offs in flexible plastic pipe lines. Where three or four connections were formerly used, only one is required now. When plastic pipe is to be joined to a metal fixture or a previously installed metallic system, an insert adapter is used. One end is screwed onto the metal threads, and then the plastic pipe is slipped over the serrated end and clamped securely. Adapters employ I. P. threads, which mate with standard female threads. All fittings are molded from a single piece of thermoplastic material and are guaranteed against rot, rust, and electrolytic corrosion. Carlon Products Corp., 10225 Meech Ave., Cleveland 5, Ohio.

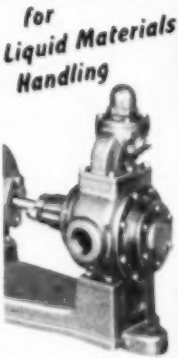
Circle No. 25 on Reply Card

Universal Nipple Chuck Threads ⅛ to 2-Inch Pipe

A Universal Nipple Chuck, capable of threading ⅛-in. to 2-in. pipe, has recently been introduced to the market. It has but three parts: 1) a polished steel body, 2) a sliding plunger, and 3) a hardened steel threaded shank. Nipples are easily removed by hand, no wrenches required. Adaptors allow for all sizes from ⅛-in. to 1½-in. pipe. No adaptor is needed for 2-in. pipe. An inserted pin retains the sliding plunger in working position. The chuck is usable four ways: with a pipe machine, a power drive, any pipe vise, or a machinist's vise. Optional is a heavy gauge sheet metal kit box for carrying chuck and a full range of adaptors. Beaver Pipe Tools Inc., 310 Dana St., N. E., Warren, Ohio.

Circle No. 26 on Reply Card

BLACKMER
Self-Adjusting for Wear
ROTARY PUMPS
for Liquid Materials Handling



THE LIFETIME PUMP WITH REPLACEABLE VANES AND LINERS TO CUT COSTS

10 TO 1500 GPM

Get FACTS About Petro-chemical Rotary Pumps . . .

See why Blackmer Pumps are preferred for liquids from ether to asphalt.

BLACKMER PUMP CO.
GRAND RAPIDS, MICH.

Trade Literature

Lube Oil Additives

Acrolube 51, Leaflet 588, and *Acrolube* 92, Leaflet 587, two-page data sheets on lube oil additives; No. 51 being formulated for premium grade motor oils to inhibit oxidation and provide detergency; No. 92 designed to permit efficient use of high sulfur fuels under severe conditions and specifically for use in Series 2 oils. American Cyanamid Co., Petroleum Chemicals Dept., 30 Rockefeller Plaza, New York City.

Circle No. 27 on Reply Card

Facts About the API

The American Petroleum Institute, Pub. No. 2001, 38-page pocket-size booklet gives a brief summary of facts about the API, its history, aims and objectives; covers divisions and service departments of the Institute; contains an organizational chart breaking down the various groups comprising the organization. American Petroleum Institute, 50 West 50th St., New York 20, N. Y.

Circle No. 28 on Reply Card

Manometers

Manual on Manometers, Bulletin 313, 12-page illustrated booklet on manometers includes basic facts and definitions on pressure measurement, how various types of manometers operate and what they measure, and detailed information on installation, operation and maintenance; English and metric tables of equivalents are given for manometer readings taken with various indicating liquids, together with temperature correction factors and instructions on how to use them. King Engrg. Corp., Box 510, Ann Arbor, Mich.

Circle No. 29 on Reply Card

Heat Transfer Equipment

G-E News, Progress issue, an eight-page bulletin illustrating various types of heaters, coolers, condensers, and exchangers for all types of liquids, vapors, and gases, and their application to oil and gas, chemical, power, and other industries. Griscom-Russell Co., Massillon, Ohio.

Circle No. 30 on Reply Card

Panel Instruments

Consotrol Instruments, Bulletin 663, 32-page booklet describing and illustrating instruments designed primarily for use with modern console and graphic panels, including the Model 53 Consotrol Recorder with a 1-in. strip chart, valve pressure indicator, control set-point scale and automatic-manual transfer switch. The Foxboro Co., Foxboro, Mass.

Circle No. 31 on Reply Card

Corrosion-Proof Cements

Atlas Corrosion-Proof Cements, Bulletin 5-2, 12-page brochure providing technical data and catalog information on the four basic types of corrosion-proof cements with graphic charts showing the temperature range of each cement and its resistance to broad classes of corrosives; resistance tables rate each cement specifically for 176 common chemical materials, and in addition, the three principal acid-proof brick and cement constructions are shown with estimating tables for each construction. Atlas Mineral Products Co., 71 Walnut St., Mertztown, Pa.

Circle No. 32 on Reply Card

Plasticizers

Pittsburgh PX Plasticizers, Bulletin PX 2-452, 14-page brochure divided into three main parts: 1) "Plastics . . . an Industry Comes of Age," 2) "The Story of Pittsburgh PX Plasticizers," and 3) a special section on the uses and properties of ten individual plasticizers offered by Plasticizer Div., Pittsburgh Coke & Chemical Co., Room 1940 Grant Bldg., Pittsburgh 19, Pa.

Circle No. 33 on Reply Card

Nickel Steel Data

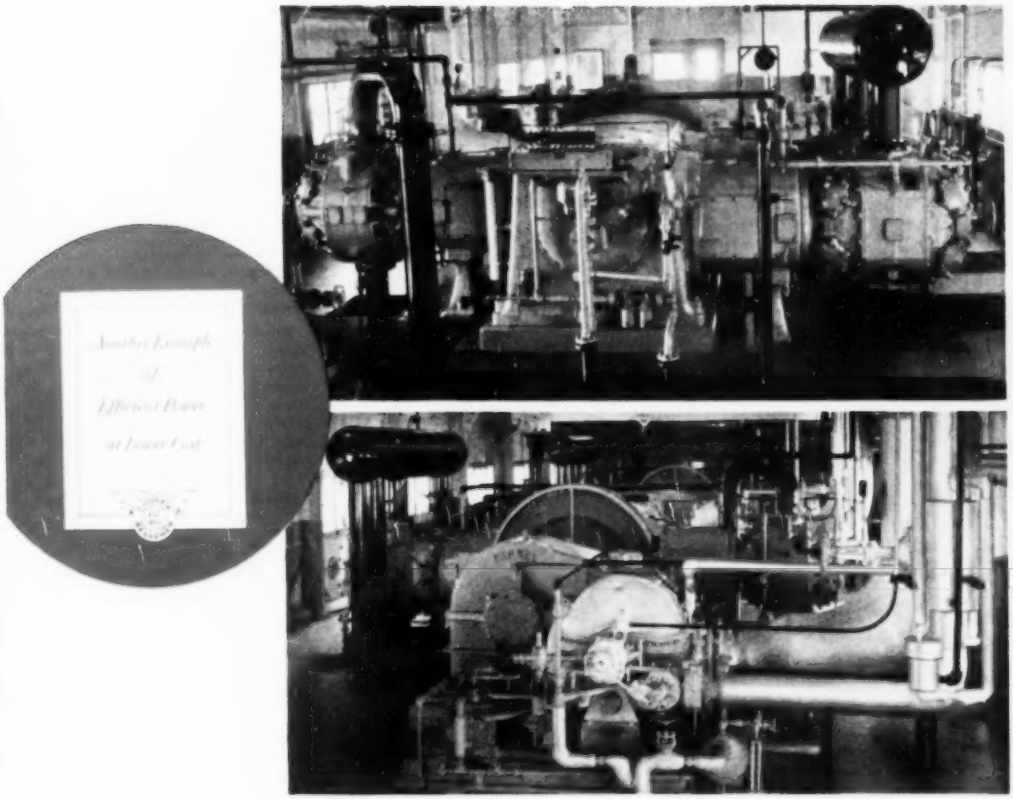
Some Properties of Low Carbon 8½ Per Cent Nickel Steel, Bulletin EU-93.20, 12 pages describing ferritic steel which is resistant to the embrittling effects of low temperatures (−320° F.) and which can be welded and fabricated under similar conditions of engineering steels; freely illustrated with 20 tables and charts depicting the mechanical properties and effects of heat treating and welding. The International Nickel Co. Inc., Dept. EZ., New York 5, N. Y.

Circle No. 34 on Reply Card

High Pressure Flow Meters

Armored Flowrator Meters, Catalog 40, 10-page booklet discusses flow meters designed for high temperature and high pressure, and for use where liquid hammer and hazardous fluids make ordinary meters impractical or dangerous; includes section on meter extensions and extension combinations. Fischer & Porter Co., 6390 County Line Rd., Hatboro, Pa.

Circle No. 35 on Reply Card



In Refinery Service . . .

COOPER-BESSEMER MOTOR OR TURBINE DRIVEN COMPRESSORS

. . . for continuous operation . . . for minimum down time

The units shown above are Cooper-Bessemer M-Line compressors in Continental Oil Company's Billings Refinery. They are turbine driven, with reduction gears, and are handling vapor and recompressor gas through 2 stages, from 17 psi to 253 psi discharge.

During their two years of continuous operation, these units have shown a typical M-Line record — smooth, trouble-free performance, minimum down time and completely satisfactory behavior in general. The reasons are simple. Combined in these units are many of the features that have contributed to the success of Cooper-Bessemer engine-driven horizontals and modern V-Angles — features that come only from years of practical experience and painstaking development work in compressor design and construction

If you have new jobs coming up requiring either motor or turbine driven compressors get all the facts on modern Cooper-Bessemers. They are available in sizes from 250 to 5,000 horsepower.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA

New York, N. Y. — Washington, D. C. — Bradford, Penna. — Parkersburg, W. Va. — San Francisco, Calif. — Houston, Dallas, Greggton, Pampa and Odessa, Texas — Seattle, Wash. — Tulsa, Okla. — Shreveport, La. — St. Louis, Mo. — Los Angeles, Calif. — Chicago, Illinois — Caracas, Venezuela

Catalyst Uses

Harshaw Catalysts. Form D-252, eight-page brochure illustrates five types of catalyst and includes a history of catalyst uses which goes back to 1868; includes processes employed by the petroleum, synthetic rubber, chemical, natural gas, fat and fatty acids industries and the typical catalysts employed in these processes. The Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, Ohio.

Circle No. **36** *on Reply Card*

Combustion Safety

Selas Automatic Fire Checks and Safety Blowouts. Bulletin SC-1006, 12-page brochure describes two protective devices used in the piping systems of gas-and-air combustion systems, viz.; the automatic fire check, used to detect, localize and extinguish a flashback in gas-air mixture lines, and the safety blowout, used to prevent damaging flashbacks in the main supply piping. Selas Corp. of America, Philadelphia 34, Pa.

Circle No. **37** *on Reply Card*

Controlled Volume Pumping

Milton Roy Air-Powered Controlled Volume Pumps. Bulletin 351; 16-page brochure contains cutaway views of a complete line of air-operated pumps, and illustrates diagrams of controls and typical air-powered systems with a description of the method employed; air consumption and capacity-pressure tables are included for pumps handling from 0.4 to 405 gph against discharge pressures up to 21,000 psi. Milton Roy Co., 1300 E. Mermaid Lane, Chestnut Hill, Philadelphia 18, Pa.

Circle No. **38** *on Reply Card*

Still Requires No Pump

The Self-Pumping Still. Bulletin SP 452; eight-page brochure describes operating function of this unique lab item which operates without a vacuum pump once initial evacuation has taken place; used for solvent recovery, distillation, fractionation, or evaporation; with capacities up to 5000 ml; prices and dimensions included. Scientific Glass Apparatus Co. Inc., Bloomfield, N. J.

Circle No. **39** *on Reply Card*

Petroleum Industry Paints

Pittsburgh Paints for the Petroleum Industry, a stiff-cloth bound, 100-page, 8½ x 11-in. book covering full information on complete line of paints useful in the petroleum industry, for all kinds of surfaces; with product description and application recommendations, color chips for all products, and a special section on "Color Dynamics"; the scientific use of color to promote efficiency and safety. Readers wanting a copy are requested to write on company letterhead direct to Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh, Pa.

Proportioning Pumps

"U" Type Pumps. Catalog UP-52; 20-page booklet describes "U" type metering and proportioning pumps with full specifications and prices, plus a section on selection of "U" type pumps for continuous, precise metering of small volume flows ranging from 0.10 to 24.0 gph, with operating pressures from 125 to 5000 psi. Hills-McCanna Co., 2323 W. Nelson St., Chicago 18, Ill.

Circle No. **40** *on Reply Card*

Data on Chlorine Compounds

Organic Chlorine Compounds. Bulletin F-4769A, 28-page booklet gives uses, physical properties, specifications, and shipping data on commercially available organic chlorine compounds including mixed chlorinated solvents; includes four pages of such laboratory test methods as specific gravity, acidity, freezing point, and determination of chlorhydrin percent by weight. Carbide and Carbon Chemicals Co., Div. of Union Carbide and Carbon Corp., 30 East 42nd St., New York 17, N. Y.

Circle No. **41** *on Reply Card*

Catalytic Vessel Linings

Bigelow-Liptak Castable-Refractory Vessel and Heat Enclosures for Oil Refineries. Catalog 35, eight pages describing new castable walls for catalytic vessel linings, cyclones, flue gas stacks and ducts, and catalytic-carrying lines with engineering drawings of typical installations. Bigelow-Liptak Corp., 2550 W. Grand Blvd., Detroit 8, Mich.

Circle No. **42** *on Reply Card*

Pressure Gauges

Pressure Gauges. Specification Sheet 708; *Indicating and Recording Pressure Gauges With Electr-O-Vane Control.* Specification Sheet 709; *Pressure Gauges With Pneumatic Control.* Specification Sheet 710; four-page brochures with construction and engineering details, tables with measuring elements and ranges, models offered, and ordering information. Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **43** *on Reply Card*

Instrument Calibrator

The Republic Low Pressure Calibrator. Form No. 52-3; four pages describing and illustrating an instrument which calibrates low pressure instruments such as diaphragm operated gages and differential pressure transmitters, measuring pressure or vacuum in increments of 0.01 in. water; includes engineering data and drawings. Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47, Ill.

Circle No. **44** *on Reply Card*

Raney Nickel Catalyst

Activated (Leached) Raney Nickel Catalyst, Code 986; single page data sheet describes physical form of the catalyst, approximate composition, application, shipping containers, nickel allocations (in accordance with General Order M-80 as amended March 12, 1952 issued by Chemical Section of NPA), and Interstate Commerce Commission classification. Davison Chemical Corp., Baltimore 3, Md.

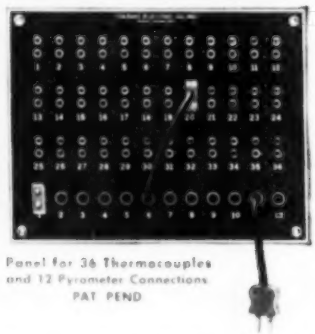
Circle No. **45** *on Reply Card*

Centrifugal Sump Pumps

Warren Centrifugal Sump Pumps, Types VS and VN. Bulletin WQ-220. Eight-page bulletin describes wet and dry pit type sump pumps, available in eight sizes, 1½ to 8 in. with capacities to 1000 gpm and pressures up to 250 psi., used for handling clear liquids, sewage and other liquids containing solids; table gives approximate pump and motor sizes at various speeds based on open impeller design. Warren Pump Co. Inc., Warren, Mass.

Circle No. **46** *on Reply Card*

CONNECTING MANY THERMOCOUPLES?



Panel for 36 Thermocouples and 12 Pyrometer Connections
PAT PEND

Use these Quick Coupling Connector Panels to provide centralized control and a rapid and flexible system for switching multiple thermocouple circuits. Polarized Plugs and Jacks of calibrated thermocouple material connect numerous thermocouples to pyrometers—regardless of their location.

Write for Catalog Section 23 I

ThermoElectric Co. Inc.
FAIR LAWN NEW JERSEY

What's New!

Odorizing LPG

A New Method for Odorization of LPG, Bulletin G-5, four-page brochure describes a method which adds an odorant directly in the gaseous phase of LPG by inserting a small cartridge containing the odorant into a specially provided cavity in the valve of the cylinders, which when released in the operation assures a highly uniform concentration of odor and at a level of odorization comparable to that of utility service gas. J. B. Calva & Co., Kasota Bldg., Minneapolis, Minn.

Circle No. **47** *on Reply Card*

Economical Pumping

Controllable Capacity Pumps, Data Sheet 65A; eight-page brochure describes applications, features, design and operation of controllable capacity reciprocating pumps which utilize power efficiently under medium and high pressure conditions, particularly where variable rates of pumping are involved; includes sizes, ratings, and engineering drawings. The Aldrich Pump Co., Allentown, Pa.

Circle No. **48** *on Reply Card*

Spiral Packings

Durametallic Handy-Pack Packings, Form No. 443; four pages discusses combination-type (metallic and plastic) spiral packings, lead foil and aluminum foil packings; includes specifications and prices. Durametallic Corp., Kalamazoo, Mich.

Circle No. **49** *on Reply Card*

Control of Liquids and Gases

Controls for Pressure, Flow, Proportioning of Liquids and Gases, Bulletin No. 139; 23 pages describing pressure and flow control principles and equipment, impulse systems for pressure control, how to calculate an orifice plate, proportioning control instrumentation, measurement and control principles as applied to viscous fluids. Askania Regulator Co., 240 E. Ontario St., Chicago 11, Ill.

Circle No. **50** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the bottom of the card and drop it in the mail. No postage required.

WHY SKILLED WORKMEN Prefer

RIDGID

Small Ratchet Threaders

Drop head sets to thread ⅛" to 2"

These Drop Head Dies Give You *Extra* Fast Easy Pipe Threading

- ★ Heads snap into ratchet ring from either side, won't fall out.
- ★ Precision-cut alloy dies reverse for close-to-wall threads—no special dies needed.
- ★ 00R & 0R, ⅛" to 1"; 111R and 11R, ¼" to 1¼"; 12R, ⅜" to 2". Conduit dies available.
- ★ Buy at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

(To obtain more data on advertised products see page 1032)

Complete 4000 barrel per day

REFINERY FOR SALE

A complete small refinery, on a 69-acre site, connected with two railway lines, linked by highways with Central Canadian and mid-western United States cities and only 15 miles from Great Lakes system docks, is offered for sale. The plant, which is at Petrolia, Ontario, becomes available because its owners, Canadian Oil Companies, Limited, are now bringing on stream a much larger, ultra-modern refinery at nearby Sarnia.

In addition to full equipment to process crude oil into gasolines, lubricating oils, greases and by-products, the refinery has:

- 30 buildings, the main units of which are of brick or reinforced concrete and with load-carrying walls.
- Adequate water supplies via town system from Lake Huron.
- Ample 60-cycle electrical power at low industrial rates from the Ontario Hydro-Electric Power Commission system.
- A central power plant, comprising two 500 HP water tube boilers.

REFINERY

Newer sections include Flash Topping, Cracking, Reforming and Polymerization, and associated Treating units required by Universal Oil Products Company processes. They have operated under U.O.P. inspection and recording and U.O.P. engineers have advised on maintenance. Crude capacity is 4,400 barrels per day. Thermal cracking capacity is 1,200 B.P.D. and reforming capacity 800 B.P.D.

Steel tank storage capacity, above ground, is 375,243 barrels. A 4-inch pipeline connects the storage facilities with dockside on the St. Clair River.

BUILDINGS

Total floor space of 80,000 square feet.

The office building, which also houses the plant laboratory, is a modern, well-built structure aggregating 9,000 square feet on two floors. Other buildings include:

- Garages
- Electrical Shop
- Pipefitting Shop
- Carpenter Shop
- Machine Shop
- Welding Shop

While built and operated as an oil refinery and efficient to process a relatively small crude oil throughput, the plant may be adaptable to other manufacturing processes.

Inquiries are invited and additional details can be supplied by:

Mr. G. S. Middaugh,
The Canadian Oil Companies Ltd.,

204 Richmond Street, West,
Toronto, Ontario, Canada.
Telephone EMpire 6-3031.

Literature in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature offered in this issue's advertisements.

ACTIVATED ALUMINA. Information offered by Aluminum Co. of America. See adv't p. 916.

ADDITIVES. Information on materials for offered by Michaels Chemical Co. See adv't p. 906.

AIR COOLERS. Booklet offered by American Locomotive Co. See adv't p. 923.

BUBBLE TRAYS. Design type Bulletin No. 629 offered by Koch Engineering Co., Inc. See adv't p. 914.

CONDUITS, electrical. Publication 6-12 offered by American Brass Co. See adv't p. 1001.

CONTROLLER, pneumatic. Complete specifications on P-A Pneumatic offered by Fischer & Porter Co. See adv't pgs. 910-912.

COMPRESSORS, centrifugal. Catalog entitled "Centrifugal Compressors for Industry" offered by Carrier Corp. See adv't p. 940.

CONTROL SYSTEMS, pneumatic. Literature offered by The Foxboro Co. See adv't p. 929.

CONVECTORS. Booklet offered by American Blower steam Co. See adv't p. 935.

DIFFERENTIAL CONVERTER. Catalog No. 2261 offered by Minneapolis-Honeywell Regulator Co. See adv't pgs. 910-911.

EXCHANGE AGENTS, packaged. Booklet offered by American Locomotive Co., Inc. See adv't p. 923.

FLOW, recording meters. Information offered by Bailey Meter Co. See adv't p. 905.

FLOW METERS, square root extractor. Catalog No. 2013 offered by Minneapolis-Honeywell Regulator Co. See adv't pgs. 910-911.

FLOW METERS, square root. Catalog No. 2262 offered by Minneapolis-Honeywell Regulator Co. See adv't pgs. 910-911.

FILTER FABRIC, acid-proof. Information offered by The Stebbins Corp. See adv't p. 927.

FITTINGS, for valve lubrication. Information offered by Rockwell Manufacturing Co. See adv't p. 906.

FITTINGS, welding end. Information offered by Taylor Forge & Pipe Works. See adv't p. 1026.

GASES, liquid level, relex. Catalog 50 offered by Penberthy Injector Co. See adv't p. 941.

GASES, liquid level, transparent. Catalog 50 offered by Penberthy Injector Co. See adv't p. 941.

GASOLINE STABILITY. Booklet offered by Ingram Co. See adv't facing pgs. 944-945.

GRAPHIC PANELS. Bulletin titled "Centralized Instrumentation" Limited offered by Minneapolis-Honeywell Regulator Co. See adv't p. 910-911.

HEATERS, immersion. 16-page booklet offered by Sivyer Corp. of America. See adv't p. 929.

HEATERS, instantaneous. Booklet offered by American District Steam Co., Inc. See adv't p. 935.

INJECTORS, automatic. Bulletin 512 offered by Penberthy Injector Co. See adv't p. 941.

INSULATION PRODUCTS. Technical bulletin offered by The Philip Carey Mfg. Co. See adv't p. 1025.

LABORATORY WARE, aluminum. Bulletin No. 262 offered by the Nichols Co. See adv't facing pgs. 924-925.

LEVEL MEASUREMENT. Bulletin No. 140 offered by Instruments, Inc. See adv't p. 1024.

METALLIC CHLORIDES. Chemical guide offered by Hooker Electrochemical Co. See adv't p. 936.

METER PURGING SYSTEMS. Bulletin H-11 offered by Cochran Corp. See adv't p. 1041.

MIST ELIMINATORS. 4-page brochure offered by Metal Textile Corp. See adv't p. 1040.

MIXERS, top-entering. Bulletin No. 160 offered by Internationale Equipment Co. See adv't p. 1024.

OXYGEN RECORDERS. Bulletin 51-52 offered by The Hays Corp. See adv't p. 943.

PAINT, protective. Information offered by Dearborn Chemicals & Oil Mills Co. See adv't p. 906.

INTALOX*

The Unique

SADDLE PACKING

Gives You

- greater surface area
- more accessible surfaces
- greater free space

Which Means

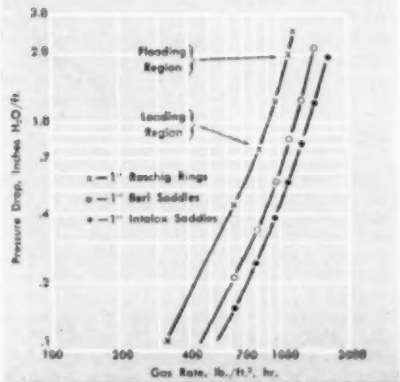
- lower pressure drop
- higher flooding limit
- higher flow capacities

TABLE ONE

Comparative Properties of Intalox

	Raschig Rings	Intalox	Berl Saddles
Nominal Size	1"	1"	1"
Approx. No./ft³	1350	2390	2200
Approx. Wt./ft³	40	39	45
Aver. Surface area ft²/ft³	58	78	76
% Free Gas Space	73	74	69

TABLE TWO



Write for detailed information, today. Ask about our 116-page reference manual,

"TOWER PACKINGS AND PACKED TOWER DESIGN"

U. S. STONEWARE
AKRON 9, OHIO

* T. M. Reg.

459C

PROCESS EQUIPMENT DIVISION

EDITORIALS

Govt. vs. Industry Economics

PRIVATE industry has by no means been asleep on the subject of coal hydrogenation, although this has been soft-pedalled by the Bureau of Mines and other government agencies who claim the salvation of our economy lies in its immediate commercial application to make synthetic liquid fuels. The Bureau has deluged the press with screwy economics to "prove" its point, get more public funds, and then come up with more cockeyed economics to cloud the issue of its boondoggling.

A few weeks ago the scientific press was shown the culmination of 17 years of research work in coal hydrogenation by a single privately-operated company. By this year's end this company will probably have spent about $5,000,000 less than the Bureau in this field of research. The achievements, however, are entirely different.

The coal hydrogenation plant of Carbide & Carbon Chemicals Co., at Institute, W. Va., is not intended to produce fuels; it is a semi-commercial pilot plant making chemicals from coal. It goes about half as far down the high-pressure coal hydrogenation route as the Bureau's "demonstration" installation at Louisiana, Mo. The chief economic difference is that Carbide's unit stops at a product containing over 100 valuable chemicals ranging in price from 40 cents to several dollars per pound, whereas the Bureau spends perhaps a dime more to convert a pound of this material to a gallon of 15-cent gasoline. The chemicals are readily salable at a profit in existing markets. The Bureau's gasoline from coal hydrogenation cannot compete with the petroleum-derived product in present markets.

The comparison of the two operations is a good example of government versus private industry economics. The Carbide company management, being responsible to stockholders who want dividends from their investment, is aimed at producing things that can be sold in today's markets or those of the near future. The Bureau set out to prove that a huge commercial synthetic fuel industry is practicable, and even essential, for this country. It will be surprising if its exponents do not try to warp the Carbide company's experience around to "prove" their own point.

New Graphitization Data

THE study into causes of deterioration of metal in the carbon steel shells of reactors of catalytic cracking units, initiated some months ago by the API following failure of a few vessels after lengthy service, has made considerable progress. Examinations already have been made in Battelle Memorial Institute of a few samples of steels in refinery service. These tests have shown evidence of graphitization in the so-called "low aluminum steels"; that is, steels in which small amounts of aluminum, 0.5 lbs. or less per ton of steel, were used for deoxidation purposes. The graphitization found so far has been of the general type and not the damaging "chain" type.

The only previous broad investigation of this cause of deterioration of steel in service was that made of carbon and low molybdenum steel in piping in power plants some years ago. The findings there indicated that severe graphitization was mostly limited to the "high aluminum" steels, in which the residual aluminum was believed to make the steel susceptible to this cause of failure.

The present findings in the oil industry's study, if substantiated by more tests in Battelle's laboratories, may reverse the previous theories as to the influence on graphitization tendency of the use of aluminum in steel manufacture. This in turn will focus attention on other possible causes for the deterioration of steel in refinery vessels subjected to high temperatures for long operating periods.

The sub-group of the API Committee on Unfired Pressure Vessels, which is conducting the study of graphitization, has recently completed arrangements with the Battelle laboratories whereby samples of steel from vessel walls can be submitted by individual refining companies and tested for a small fee per sample. The committee hopes that many refiners will avail themselves of the opportunity and submit samples for examination.

The results of all phases of the API study of graphitization when completed will be made available to the entire industry. With the trend towards larger vessels for processing and under more severe operating conditions, this cooperative effort of the industry may prove a valuable investment in conclusively determining the factors that influence the rate of deterioration in service of carbon and low molybdenum content steels. —V.B.G.

Chemical Research and Washday

THERE is no better illustration of the wide programs of market development research carried on by the chemical manufacturing companies than their concern over the handling and laundering of the new synthetic fibers used in men's and women's wearing apparel and other fabrics.

Spokesmen for the leading chemical companies manufacturing these new synthetic materials used with wool and other natural fibers say the amount of misinformation prevalent concerning the new textile fibers is appalling and that facts must replace fantasy in promoting them. They are considering educational programs to bring the facts to the public as to what the new fabrics will do, how they must be handled and laundered or cleaned.

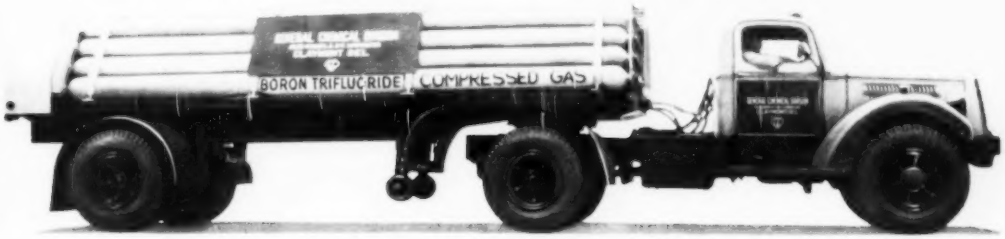
This is not the only instance where the chemical companies have taken on the job of educating consumers in the use of items in which new chemical products were incorporated. They have a much wider concept of market research and development than do the oil companies now getting into the chemical field. The latter can hardly be expected to take as great concern over the end use of the products as the chemical companies which make the finished materials. However, even with their raw and intermediate products, the oil companies might find market development research a good tool for widening the utilization of these products. —V.B.G.

NOW, GENERAL CHEMICAL BRINGS INDUSTRY THIS

Versatile Catalyst

BORON TRIFLUORIDE

in Many Forms...in Tonnage Quantities*



A LABORATORY CURIOSITY less than a decade ago, now an industrial chemical of tremendous significance as a catalyst—that is the story of Boron Trifluoride as developed by General Chemical's fluorine research program.

Today, the catalytic properties of Boron Trifluoride — both as a compressed gas and in its various complexes — are being utilized in many major industrial fields. These include petroleum, synthetic rubber, resins, solvents, plastics, dyestuffs, metallurgy, etc. With it, many hitherto impossible operating problems involving organic reactions are being solved.

To meet every processing need, General Chemical produces Boron Trifluoride both as a gas and in a wide range of complexes. Recently, General began regularly-scheduled tonnage shipments of the compressed gas by tank truck, marking another milestone in the expanding use of this new industrial chemical.

Listed at the right are many of the reactions in which General's BF_3 is now being utilized. If your operations involve these or similar techniques, you may find it advantageous to investigate Boron Trifluoride and its complexes.

For further information, for experimental samples of any of the products listed, or for confidential discussion of your particular needs, consult the nearest General Chemical office serving you.

Present or Potential Uses of BF_3 as a Catalyst

POLYMERIZATION

ALKYLATION

ESTERIFICATION

ISOMERIZATION

CYCLIZATION

ACYLATION

BASIC CHEMICALS

FOR AMERICAN INDUSTRY

GENERAL CHEMICAL'S BF_3 PRODUCTS

Commercially Available in Tonnage Quantities

Compressed Gas	
Phenol Complex	(Liquid)
Etherate Complex	(Liquid)

Available in Limited Commercial Quantities

Ammonia Complex	(Solid)
Diacetic Acid Complex	(Liquid)
Di-normal Butyl Ether Complex	(Liquid)
Dihydrate	(Liquid)
Piperidine Complex	(Solid)

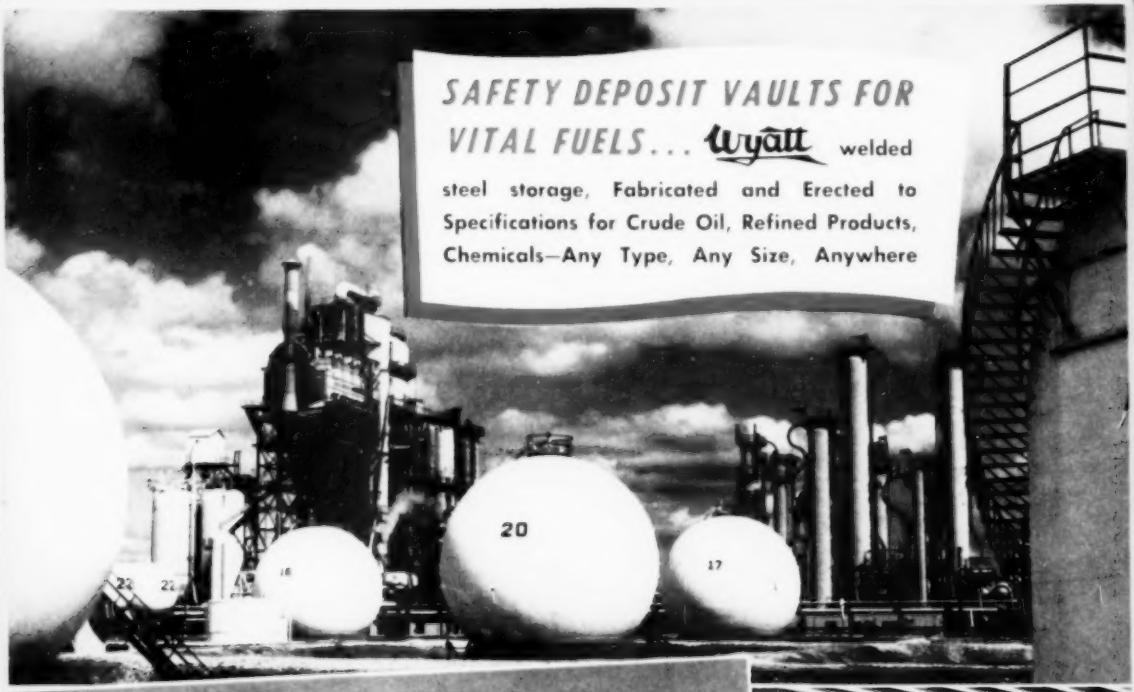
Other Complexes

In addition, extensive research and production facilities place General Chemical in a preferred position to work with you in development of other BF_3 complexes to meet individual specifications.

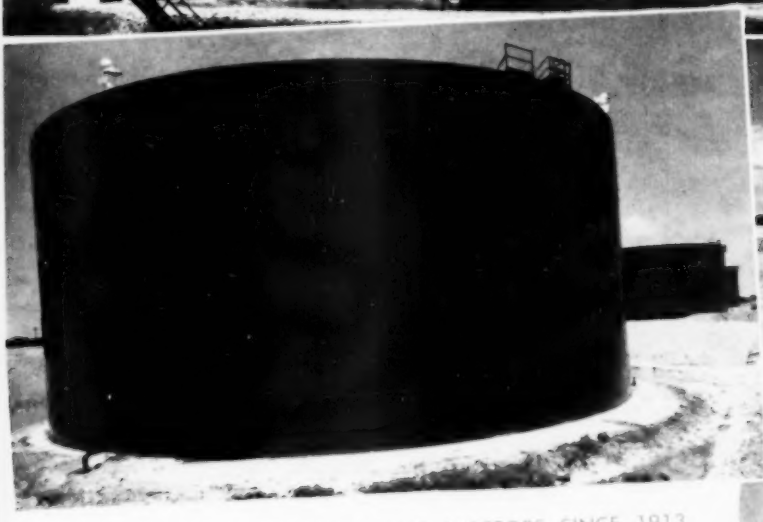
GENERAL CHEMICAL DIVISION

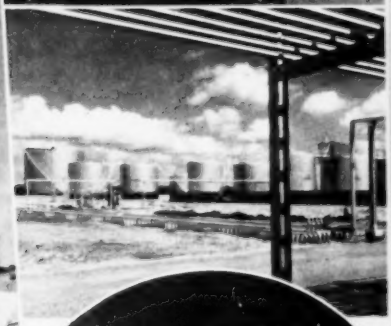
ALLIED CHEMICAL & DYE CORPORATION

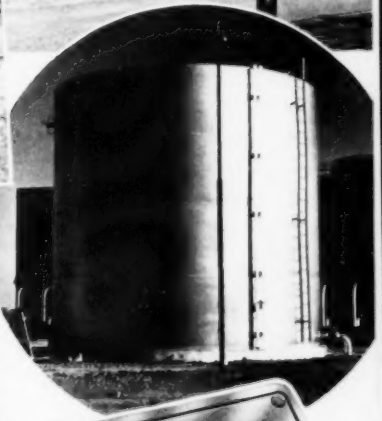
40 Rector Street, New York 6, N. Y.



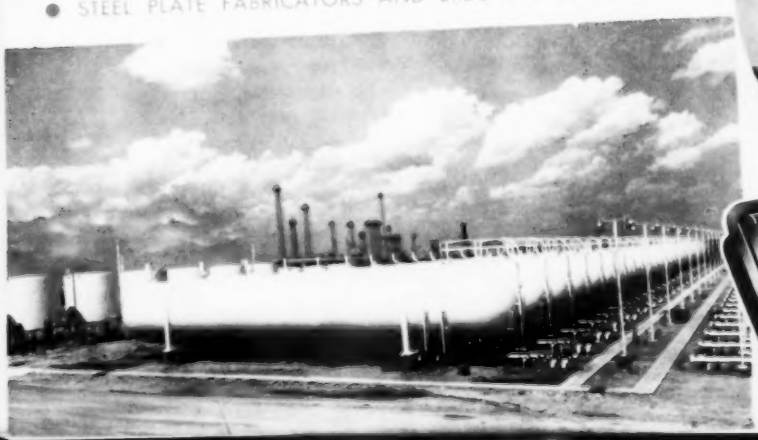
SAFETY DEPOSIT VAULTS FOR VITAL FUELS... Wyatt welded steel storage, Fabricated and Erected to Specifications for Crude Oil, Refined Products, Chemicals—Any Type, Any Size, Anywhere







● STEEL PLATE FABRICATORS AND ERECTORS SINCE 1913



Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA